THE BLACK-FOOTED FERRET IN NEW MEXICO

By

JOHN P. HUBBARD AND C. GREGORY SCHMITT

Endangered Species Program
Department of Game and Fish
Villagra Building
Santa Fe, New Mexico 87503, USA

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INTRODUCTION

The black-footed ferret, Mustela nigripes (Audubon and Bachman), is an endemic mammal of North America, and at one time it ranged from the Prairie Provinces of Canada to the southwestern United States—including New Mexico (Hall 1981: 999-1000). The ferret has generally been presumed to be rare ever since its description in 1851, but by the mid-twentieth century declines in range and numbers raised concerns that the species would soon be extinct. As part of the movement to conserve the species, it was listed as endangered in 1964 (U.S. Department of the Interior 1964), and it continues to be so designated.

The status of the black-footed ferret in New Mexico is poorly known, having been treated in a general way by authors such as Bailey (1932) and Findley et al. (1975). The present report is an attempt to improve our understanding of the status of this species in the state, including as it relates to prairie dog (Cynomys spp.) management and related matters. The Bureau of Land Management has provided a major portion of the funding for the production of this report, including the 1982 publicity campaign on ferrets in the state. This funding is partly contingent on the New Mexico Department of Game and Fish meeting at least the following objectives (Section 3.2, Specific Tasks, in Contract No. NM-910-CT1-7):

1. Assembly and summarization of available published and unpublished surveys, studies, and reports on the black-footed ferret in New Mexico (Task 3.2.1).

2. Solicitation and evaluation of reports of the black-footed ferret in New Mexico, primarily from autumn 1981 through summer 1982 (Task 3.2.2).

3. Receipt, screening, and investigation of reports of black-footed ferrets in the contract period, to include on-the-ground searches by Department and/or Bureau personnel for higher probability reports (Task 3.2.3).

These various tasks and others have been accomplished, and they are detailed and discussed in this report. It should be understood that the present document merely represents a milestone in our efforts in behalf of the black-footed ferret in New Mexico. In particular, Department personnel will continue to solicit, evaluate, and investigate reports of ferrets in the state — with the hopes that a remnant population will be found and the status of the species and its conservation needs can be improved. Although we have no hard evidence that this species persists in New Mexico, at the same time we see no compelling reason to believe that it has been extirpated.

BACKGROUND INFORMATION ON THE BLACK-FOOTED FERRET.

Our purpose here is not to provide an exhaustive summary of either the life history or related matters involving the black-footed ferret. For one thing, many details remain to be learned about the species, although ongoing studies in the Bighorn Basin of Wyoming should improve this situation considerably. For another, various other publications have summarized much of the relevant information on the ferret, and we see little point in repeating that here. However, we do see a need to discuss those aspects of ferret life

history, et cetera that we judge to be relevant in our attempts to elucidate the status of this species in New Mexico.

TAXONOMY AND EVOLUTIONARY HISTORY.

The black-footed ferret is a member of the widespread family Mustelidae, in which Honacki et al. (1982) recognize 23 living genera and 63 species. The genus Mustela Linnaeus contains 16 species and is the largest in this regard in the family. Of the 16 species, five—including M. nigripes—are endemic to the New World, nine are restricted to the Old World, and two are shared. Some workers have recognized additional genera or subgenera for certain species in Mustela, including Putorius Cuvier, in which the black-footed ferret was originally described (Audubon and Bachman 1851). Although Hall (1981:999) questions even subgeneric recognition of Putorius, other workers accept it as a convenient grouping for three forms—i.e., the European ferret or polecat (Mustela putorius Linnaeus), the Siberian or steppe ferret (M. eversmanni Lesson), and the black-footed ferret. We are not conversant with all the bases for these species being associated, but on the face of it the arrangement appears to have merit.

Other than the mention of this subgeneric grouping for ferrets, we do not intend to probe the taxonomy of ferrets in detail. For one thing, there still exists a degree of uncertainty about the specific distinctness of the various forms in this complex. In fact, Anderson (1973; 1977) has suggested that nigripes, eversmanni, and perhaps putorius may be conspecific—based on intergradation or overlap in cranial and other characters. The question of specific distinctness is particularly complex between putorius and eversmanni, which Stroganov (1962:362-365) strongly argues are "good" species. He claims that their ranges overlap broadly and that intergrades are rare at best. In regard to M. nigripes, the question of whether it is a species or a distinct subspecies should seem largely academic. After all, this distinctive form is allopatric, and whether species or subspecies, it clearly deserves stringent efforts toward its conservation. And yet we do see relevance in further studies of the taxonomy of this group—as outlined below.

First, we are concerned that the frequent release or escape of European ferrets within the historic range of M. nigripes could—and probably already has—bring the two forms into contact. This contact could conceivably lead to hybridization or worse, which would obviously be to the detriment of the black-footed ferret. In addition, workers such as Clark (e.g. 1976; 1978) have come to regard M. eversmanni as a virtual surrogate for M. nigripes, at least in considering some aspects of behavior or habitat use. While the possibility of expanding studies of the Siberian ferret (e.g. to learn more about M. nigripes) may have been reduced by the recent discovery of a viable population of the latter species in Wyoming, this matter could be revived. Even if it is not, we feel that more should be learned about M. eversmanni—including taxonomically. If for no other reason, the issue of taxonomy merits attention in the context of the latter's potential for interbreeding with M. nigripes—as unlikely a prospect as this may seem.

Whatever their taxonomic status, ferrets in North America have a history that extends back for thousands of years. Osteological remains that are indistinguishable from those of the black-footed ferret date from the latter half of the Pleistocene, including in the last interglacial (Sangamonian) in Alberta and Nebraska and the last glacial

(Wisconsinan) epoch in Idaho, Montana, Wyoming, Colorado, New Mexico, and Texas (Anderson 1977). Another record of this species from Nebraska has been attributed to an even earlier glacial epoch, i.e. the Illinoian (Anderson 1977); however, the age of that find may be more recent than this (E. Anderson, pers. comm.). Nonetheless, based on these and other data, and assuming an Old World origin for the subgenus Putorius, it would appear that the ancestor of the black-footed ferret arrived in North America—over the Beringian land bridge—no later than during the next-to-last (Illinoian) glacial epoch. How quickly M. nigripes may have subsequently differentiated one can only guess, but it may have been by or during the subsequent interglacial epoch (Sangamonian), and it certainly had by the Wisconsinan.

How long the black-footed ferret has been so closely associated with prairie dogs is also a matter of speculation. However, paleontological remains attributed to this species are associated with those of prairie dogs at several sites in North America (Hillman and Clark 1980), all these being of Sangamonian or more recent age and all in or near the present range for both taxa. There are also late Pleistocene remains attributed to black-footed ferrets from sites in which prairie dogs were not found; however, in all but one case, prairie dogs were or probably were in the same general area. The exception is in a Wisconsinan age site from the Old Crow area of the northern Yukon (Harington 1970), where Cynomys is quite unknown—either recently or prehistorically (Pizzimenti 1975). The Old Crow ferret specimen—consisting of a right ramus—has been reexamined by Anderson (1977), who stated that it "may be refereable to Mustela eversmanni beringiae." The latter taxon is an extinct race of the Siberian ferret, described by Anderson (op. cit.) from probable Wisconsinan deposits from the vicinity of Fairbanks, Alaska. Although Anderson's reassignment of the Old Crow specimen as M. eversmanni is somewhat tentative, the occurrence of that species instead of M. nigripes in the Yukon is reasonable—especially given its occurrence during a glacial epoch, when more southerly populations of the latter species would have been disjoined by continental glaciers. Presumably M. eversmanni entered into the unglaciated areas of Alaska and the Yukon from Eurasia, crossing the Bering land bridge during the Wisconsinan—just as the ancestor of M. nigripes did during the previous glacial epoch.

This saga of the ferrets in North America suggests that a certain amount of change has accompanied the group's history here, including in range, habitat associations, and prey relationships. As for the ancestor of M. nigripes, as it moved southward it no doubt found prairie dogs an easily exploited food source—which had, so to speak, been ready and available since well before the ferret's arrival. By the end of the last glacial epoch, the black-footed ferret had probably become the prairie dog specialist that we know today.

DISTRIBUTION

As stated earlier, the black-footed ferret at one time ranged from the Prairie Provinces southward to the southwestern United States. The historic distribution of the species is shown in Figure 1 based mainly on Hall (1981:999-1000)—with updates and modifications from such sources as Kearney (1983). In addition to its occurrence in New Mexico (discussed in detail later), the ferret also occurs or has occurred in the adjacent states—including Utah, Arizona, Texas, Oklahoma, Colorado, and Kansas.

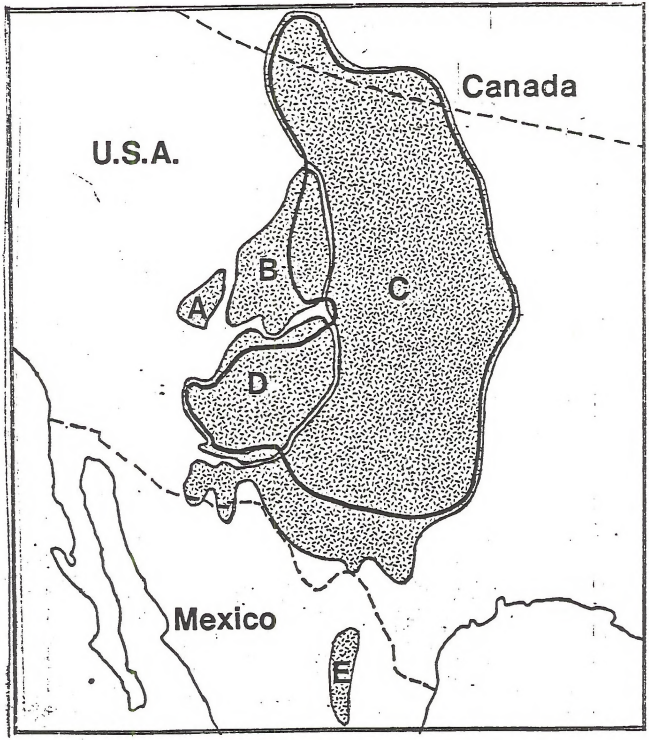


FIGURE 1. The distribution of the black-footed ferret (dark outline), as superimposed over the ranges (dash-pattern) of the species of prairie dogs: A. Utah; B. white-tailed; C. black-tailed; D. Gunnison's; and E. Mexican. (Based mainly on Hall 1981.)

In Utah, the black-footed ferret appears to be known from one verified record—a specimen taken in the extreme southeast (Durrant 1952:421-422). Arizona occurrences are from the northeastern quarter of that state, and verified records are based on four specimens (Cockrum 1960). Two of these were taken in 1917 and 1929 (Young and Halloran 1952:251), but we do not know the dates for the others.

In Texas, Davis (1974:101-102) attributes the species to " . . . the Panhandle, much of the Trans-Pecos, and a considerable part of the rolling plains east and south of these areas." However, there seems to be only one verified record of the species in the Trans-Pecos, that being a specimen taken in the northeastern corner of the area (Schmidly 1977:145). Hassien (1976:38) lists five specimens from that state (1886 to 1904), including the one mentioned above—which is from Ward rather than Pecos County (Schmidly op. cit). In Oklahoma, the historic range of the black-footed ferret included the western two-thirds of the state, with four specimen records from the period 1923 to 1927 (Hassien op. cit.).

The Colorado distribution of this animal was almost statewide, with records lacking only in the central-western region (Armstrong 1972:279-280). Armstrong (op. cit.) lists 30 specimens that he examined from that state, while Hassien (op. cit.) lists 36 from there—these being taken in the period 1878 and 1943. However, we have learned of more recent specimen records, these dating from the 1970's (J. Torres, pers. comm.). In Kansas, the black-footed ferret historically occurred in the western two-thirds of the state, and 36 specimens were collected in the period 1884-1944—plus two others in 1957 and 1978 (Choate et al., 1982).

ABUNDANCE

Until fairly recently, the usual view of the abundance of the black-footed ferret has been that the species was rare—even in earlier historic times. This conclusion was based on a number of factors, including the fact that 25 years elapsed between the description of the species in 1851 and the collection of the next specimen in 1876 (Fortenbery 1972). However, there is reason to doubt that the relative scarcity of records—or at least specimens—necessarily indicated rarity of ferrets. For example, Choate et al. (1982) state that the species " . . . might have been relatively common (albeit probably never abundant) in some of the large prairie dog towns . . . in western Kansas before the turn of the century." In fact, these authors show that 26 specimens of ferrets were collected in two adjacent counties (Trego and Gove) in the period 1884-1891—an average of two-plus per year for eleven years! One would suspect that the collectors had discovered a means of taking ferrets (i.e. trapping?) that might have more genuinely reflected the animal's abundance, even though one collector—A.B. Baker—is quoted as saying that the species was "nowhere numerous" (Choate et al. op. cit.).

In South Dakota, Linder et al. (1972:25) report that an employee of the Bureau of Biological Survey remarked in 1923 that the species was " . . . not uncommon" in parts of South Dakota. Prophetically, 42 ferrets were taken there by the Bureau in the five years following 1923 (Linder et al. op. cit.)—an average of eight per year! More recently, studies of the ferret population in northwestern Wyoming (Bighorn Basin) have yielded counts of several score of animals at peak times of the year. For example, in 1982 up to

59 ferrets were accounted for (Kearney 1983), and in 1983 the figure was 70 animals (C. Carley pers. comm.)! This is hardly our concept of rarity, especially in a carnivore of this type.

We feel that it is important to delve into the question of the historical or, perhaps better, "normal" abundance in the black-footed ferret—even in the face of a paucity of data. This importance lies in the need to help create as objective as possible a framework of expectation concerning density factors that might weigh in our efforts to conserve the species. If we accept the premise that this species was always rare, then it may follow that one would also assume that it was declining even prehistorically—well before man's impacts on it increased, e.g., through such activities as his massive prairie dog control programs. If we assume that the ferret was already a declining species, then we may become more prone to view it as "programmed for extinction." This, in turn, could lead us to expend less than a full effort to conserve the species—a position that we regard as unthinkable.

In addition, the acceptance of assumptions that ferrets were always rare, e.g., even before increased impacts on them by man, could also lead one to view low densities of these animals as "normal" and therefore perhaps sufficient to maintain populations. By accepting low densities as normal, we may also come to accept the idea that viable ferret populations can be small as well. This view, in turn, could lead to an inadequate allocation of resources (e.g., prairie dog areas) for conservation of ferrets.

In view of the implications that underestimating "normal" abundance in ferrets might have on efforts to conserve the species, we feel that special emphasis is needed for assessing the data properly. Based in part on the information that we have presented, we feel that pronouncements of ferrets having traditionally been rare are almost certainly specious. On the contrary, we are of the opinion that the black-footed ferret was probably a relatively common carnivore in at least part of its historic range. In fact, given the elusive nature of the species, the inadequacy of most efforts to detect it, and the general inattention paid it, we feel that the data base in support of our view of commonness is relatively large.

ASSOCIATION WITH PRAIRIE DOGS

If there is any factor connected with the black-footed ferret that borders on near-constancy, it is the almost universal association between it and prairie dogs. Figure 1 shows that the overall distribution of the ferret overlaps the ranges of three of the five species of prairie dogs, including almost all the ranges of the black-tailed prairie dog (Cynomys ludovicianus) and Gunnison's prairie dog (C. gunnisoni), plus about half that of the white-tailed prairie dog (C. leucurus). Only the extreme southern edge of the range of the black-tailed prairie dog lacks verified reports of ferrets, but even there the latter may well have occurred. The narrowly distributed Utah prairie dog (C. parvidens) and Mexican prairie dog (C. mexicanus) were seemingly spared the presence of ferrets, based on the available information.

Not surprisingly, the literature on the black-footed ferret and its association with prairie dogs revolves primarily around the ferret's use of these rodents as prey. In this

regard, there are several anecdotal accounts that deal with ferrets pursuing, dragging, killing, eating, and/or otherwise interacting with prairie dogs as potential prey—both in the wild and in captive situations. In one of the few detailed studies of this prey relationship, Sheets et al. (1972) found that remains of black-tailed prairie dogs were present in 91% of 82 ferret scats from South Dakota and made up 86% of the weight of all identifiable animal matter ("mouse" remains made up the rest of the animal weight in the samples).

We do not question the likelihood that prairie dogs are important, if not essential, prey for ferrets. However, the data to date are limited, and somewhat unbalanced. For example, it is not surprising that prairie dog remains would predominate in the analysis of Sheets et al. (op. cit.), because the ferret scats were taken from burrows in an active prairie dog town. In other words, prairie dogs would likely have been the most available prey for these ferrets, and one would expect them to be so used. To what extent ferrets are "obliged" to prey on prairie dogs is thus not probed in a study such as this, and yet this is an essential question to answer.

Unfortunately, opportunities to study the diet of wild ferrets have been so limited until recently, that even data from prairie dog towns have been almost lacking. In addition, what few data there are have been almost strictly from the range of the black-tailed prairie dog—a species that differ in several notable respects from other prairie dog species with which ferrets are known to be associated. The differences that may be most significant to ferrets in the ranges of different species of prairie dog may be those that relate to the availability of these animals as prey, as discussed below.

White-tailed prairie dogs, and the kindred Utah and Gunnison's prairie dogs, are members of the subgenus Leucocrossuromys—versus the nominate (i.e., Cynomys) subgenus for the black-tailed and Mexican prairie dogs. While this subgeneric distinction is based on standard taxonomic characters, it also correlates with such things as behavioral differences. For example, workers as early as the late nineteenth and early twentieth centuries perceived the black-tailed prairie dogs as being more social, often living in larger aggregations, and being less prone to inactivity in winter than such species as the white-tailed and Gunnison's prairie dogs (e.g. Merriam 1902; Hollister 1916).

Subsequent studies have expanded these and other perceptions considerably, although much still remains to be learned about prairie dogs—especially in regard to forage requirements and impacts in various parts of their range. In terms of their significance to ferrets, among the most important behavioral differences among species of prairie dogs are such things as aggregation characteristics and degree of winter activity—which relate back to availability as prey.

In an important study comparing black-tailed and white-tailed prairie dogs in north-central Colorado, Tileston and Lechleitner (1966) found that the former species was active above ground in good weather throughout the year—contrasted to white-tailed prairie dogs, which were inactive between November and March. In Wyoming, white-tailed prairie dogs were found to be inactive above ground from November through February or March (Bakko and Brown 1967; Clark 1977). Whether this inactivity is termed hibernation or something else, its occurrence can be expected to increase the energy

needed by ferrets to locate prairie dogs as prey—in spite of the ferret's demonstrated digging ability (Progulske 1969) and apparent good sense of smell (Henderson et al. 1969). This increased energy expenditure by ferrets is likely to be exacerbated by the facts that white-tailed prairie dogs typically plug their burrows during this period (Clark op. cit.) and these may also be covered by snow.

Gunnison's prairie dog is also known to have reduced activity above ground in winter (e.g. Hollister 1916; Bailey 1932; Scheffer 1947), especially during severe weather and/or periods of heavy snow cover. In the higher parts of its range, the conditions that would seem to induce inactivity in the white-tailed prairie dog may also be prevalent in the Gunnison's prairie dog, namely limited food availability and bad weather. Even in New Mexico, Gunnison's prairie dogs are known to occur at elevations up to 10,000 feet, and montane areas can be decidedly inhospitable places for prairie dogs to be above ground in winter.

In addition to the periods of winter inactivity in leucocrossuromydid prairie dogs, black-footed ferrets preying on such animals may also face the prospect of a less dense prey resource than may be the case in many populations of black-tailed prairie dogs. For example, Stromberg et al. (1983) calculate an average density for white-tailed prairie dogs of 1.6 per acre, based on data from Wyoming and Colorado. By contrast, they calculate the density for black-tailed praire dogs at 6.1 per acre, based on data from those two states and South Dakota.

On the other hand, Campbell and Clark (1981) have pointed out that comparisons of densities in these two species of prairie dogs did not show that consistent differences in Wyoming. As the authors suggest, many variables come into play in evaluating densities, including productivity of the sites that are occupied and the degree of control exerted on the colonies. Furthermore, it is possible that intrinsic, species-specific density characteristics either do not exist among prairie dogs or do not exert dominance over external factors. Nonetheless, given that the habitats of leucocrossuromydid prairie dogs are more often interrupted by areas unsuitable for occupancy, the overall availability of these animals to ferrets is probably less than in many populations of black-tailed prairie dogs. This is especially the case in higher elevational areas, where colonies of at least Gunnison's prairie dogs may be quite insular and disjoined from each other.

Clark (e.g., 1976) and his coworkers (e.g. Campbell and Clark 1981) have especially been among those to emphasize the potential for the differences in availability among the various species of prairie dog to impact on local populations of black-footed ferrets. These authors develop the idea that the lesser winter availability of white-tailed prairie dogs could have led to attendant ferrets to become less selective in their prey selection than in areas where colonies of black-tailed prairie dogs are utilized. This is an intriguing concept, and it will be certainly explored in the intensive studies of ferrets now in progress in the Bighorn Basin of Wyoming.

Clark's concept of a lessened selectivity in the prey base by ferrets in the range of the white-tailed prairie dog would also seemingly apply in the case of the Gunnison's prairie dog. As indicated above, there are parallels in lessened availability between the two species of prairie dog, both in terms of winter inactivity and probable low overall

densities in populations. If, in fact, more flexibility in prey selection exists in ferret populations that occur in the ranges of leucocrossuromydid prairie dogs, then this is a cause for optimism. It could mean that, in spite of losses of prairie dogs through control, sylvatic plague, habitat conversion, and so on, ferrets might have been able to survive in some areas until prairie dogs either resurged or could be located elsewhere by dispersing ferrets.

As a cautionary note, we would emphasize that Clark's concept on ferret prey selectivity remains to be substantiated, and it should be viewed as a working hypothesis rather than shift in management perception. So far, the data at hand strongly establish the bond between the black-footed ferrets and prairie dogs. Although there are instances of ferrets being reported away from prairie dog colonies (e.g. Clark 1978), there is no proof that viable populations of this carnivore can exist in the absence of prairie dogs. Until such proof is forthcoming, the linkage between ferrets and prairie dogs should be regarded as an essential tenant in the conservation of this endangered species.

In conjunction with this concept of linkage, Stromberg et al. (1983) have calculated the population sizes of prairie dogs that would be needed to maintain female ferrets and their litters as viable components of the ecosystem. These calculations are based on projected annual energy needs of ferrets, prairie dog energy yields, populational dynamics in both species, and related factors. The estimated populational needs for a single female ferret and her litter range from 474 to 1421 black-tailed and 417 to 1236 white-tailed prairie dogs—with the median values being 766 and 666, respectively. The annual harvest levels by ferrets in these populations are estimated at 214 black-tailed and 186 white-tailed prairie dogs. In order to sustain such prey bases, these authors estimate that 91-235 acres of black-tailed and 212-877 acres of white-tailed prairie dogs would be needed—using densities already discussed in each species.

While exercises such as those of Stromberg et al. (1983) are useful and stimulating, prairie dog management that is designed toward conserving the black-footed ferret will probably not be subject exacting prescription in the near future, if ever. In this regard, we feel that it is essential that the most liberal views possible apply in conserving prairie dog populations for potential use by ferrets—especially on public lands. Fine-tuning in terms of population sizes can come later, if and when prairie dog numbers must be reduced. In the meanwhile, no eradication of prairie dogs should occur in areas where ferrets might occur, unless highly justified and properly overseen to protect this carnivore.

SOURCES OF MORTALITY

In this section we will emphasize those sources of mortality that might be regarded as "unnatural," at least in the context of the recent evolutionary history of the black-footed ferret. In other words, we do not intend to outline such natural sources of mortality as those related to predation, weather, starvation, established diseases, and so on—except as might be exacerbated by unnatural factors, i.e, those typically associated with European man. For information on natural sources of mortality, we refer the reader to such authors as Henderson et al. (1969). Beyond these, the unnatural sources of mortality that concern us most are: (1) those associated with the collapse of the ferret's

major prey base (prairie dogs) due to control programs or to sylvatic plague; (2) those that might result from the direct effects on ferrets of control agents; and (3) that of plague.

We do not wish to imply that other sources of "unnatural" mortality are unimportant for ferrets, for in the aggregate they may be—including losses to domestic predators such as dogs (Canis familiaris), trapping, shooting, and vehicle collisions. However, we suspect that ferret populations can viably sustain these as well as natural sources of mortality, as long as habitat requirements (e.g., prairie dogs) are adequately met. On the other hand, the three sources of mortality named above are perhaps serious enough to affect survival of not only populations of ferrets but of the species itself. Let us add that, in discussing these and related factors, we will do so mainly in general terms—given our general lack of more specific data and other considerations.

In regard to the effects of a sudden collapse of the prairie dog prey base on a ferret population, we can conceive the impacts as occurring in several stages. Whether caused by control or plague, if the collapse produces a drastic reduction in prairie dogs, it is likely that ferrets will at first feed on the dead and dying animals among these. As these become unacceptable or unavailable, then ferrets will probably concentrate on capturing surviving prairie dogs—perhaps expending considerable effort in the process and probably stressing themselves at the same time. At some point of diminishing return, the ferrets must eventually abandon a prairie dog town in which all or most of these rodents have been eliminated. No doubt there will already have been some mortalities beforehand among the ferrets, as old, young, and otherwise vulnerable animals may have become too stressed to survive. With the exodus of ferrets from the town will come other mortalities, and if conditions are poor for successful dispersal (e.g. bad weather and/or lack of nearby alternative prey sources), then mortality rates could increase dramatically.

We do not know that the scenario above has occurred in ferret populations, but it is difficult to conceive otherwise—not once but many times. To be sure, in many cases the collapse of prairie dog towns would not have been as drastic as here outlined. Consequently, ferret populations under such circumstances—although suffering some mortalities—would probably not have been direly affected. However, in many cases the effects of control operations or plague in reducing prairie dogs probably would have been this severe, and thus ferret mortalities would have been equally severe.

Further complicating the problems resulting from the loss of a controlled prey base would have been the direct mortalities inflicted on ferrets by the control agents themselves. Among others, Henderson et al. (1969) discuss the effects on ferrets of such agents as strychnine and compound 1080 (sodium flouroacetate), both of which are lethal in relatively small doses to European ferrets. We suspect that black-footed ferrets have suffered significant mortalities from such agents, especially where hunger forced them to feed on dead or dying prairie dogs and other afflicted prey species.

In addition, the gassing of prairie dog towns—using agents such as carbon bisulfide or calcium cyanide—has no doubt also inflicted mortalities on ferrets, even though this method of control has generally been used on a lesser scale than poisoned baits. In some cases, ferrets may have been able to dig out of the burrows that control personnel plugged to increase the effectiveness of control, thus avoiding being killed by the gases. Such an

instance may have occurred in the Moreno Valley (Colfax County) of New Mexico, where Aldous (1940) found an adult black-footed ferret and two young above ground after a gassing operation. Unfortunately, gassing of prairie dog towns is still occurring, using the agent phostoxin (e.g., Anon. 1983). Besides killing prairie dogs and no doubt ferrets, gassing is also known to destroy animals such as burrowing owls, Athene cunicularia (P. Ramsey, pers. comm.), and no doubt other non-target species.

Regardless of what agents are used, we suspect that they are merely the "icing on the cake" in causing mortalities to ferrets living in prairie dog towns that collapse due to massive control. The possible exception to this may have been in the case of compound 1080, the secondary poisoning effects of which may have been as great at times on ferrets as those of the loss of the prey base.

Whether the actual agents of control of prairie dogs were as potent a source of mortality on ferrets as the collapse of the prey base, we can only speculate (except probably for compound 1080). However, the coupling of these two factors must be regarded as the single most devastating blow that could have been inflicted on the ferret, given its apparent dependence on prairie dogs and the massive efforts that went forward to eradicate these rodents. As we will show later in this report, the extent of this onslaught in New Mexico alone amounted to 45.1% of the state's acreage being treated to control rodents and lagomorphs between 1914 and 1981. Repeated from state to state across the range of the ferret in the United States, is it any wonder that the species became endangered?

As if the loss of prairie dogs through control operations were not enough, the appearance of sylvatic plague in rodents in New Mexico in the 1930's (Laney 1950) could not have come at a more inopportune time for ferrets. Given the high rate of mortality that plague can and does inflict in prairie dogs (see "Sylvatic Plague and Its Impacts" later in this report), plus the widespread nature of the disease (Barnes 1982), one has to wonder if the ferret could possibly survive this second onslaught on its major prey base. To make matters worse, man is able to exert little control over plague in wild animals—with the result that it may sweep through prairie dogs and other species with abandon. Thus, even if poison and gassing campaigns against prairie dogs were to be stopped or moderated, only half the battle to maintain ferret habitat would be won. Whether the other half can be won remains to be seen.

We listed as a third area of concern, in terms of an unnatural mortality factor on ferrets, that of the possible effects of plague on these animals themselves. This concern is perhaps unwarranted at this time, as there is little so far to suggest that ferrets are subject to many, if any, mortalities from this disease. However, carnivores can and do suffer mortalities from plague, including domestic cats (Felis catus)—which show a death rate of up to 50% in some instances (Rollag et al. 1981). With regard to mustelids, Barnes (op. cit.) has summarized the incidence of plague antibodies in several species from the western United States. Although no black-footed ferrets were included in the sample, 19 long-tailed weasels (Mustela frenata) showed an antibody incidence of 26.3%. The level in the related martens (Martes spp.) was 30.6%, for a sample of 49 animals. These are relatively high levels of plague-antibody incidence, although they are exceeded in a sample of 12 ringtails (Bassariscus astutus) and approached in 104 black bears (Ursus

americanus) and 383 badgers (Taxidea taxus)—which showed levels of 50.0, 23.0, and 21.9%, respectively. Whatever the case, we feel that more research needs to be directed toward the possible direct, dilatory effects of plague on the black-footed ferret. At the very least, assurances might be obtained to rule this disease out as any significant threat to the species.

We have raised the matter of significant, unnatural mortality factors in black-footed ferrets for two main reasons. One is to help understand how such factors may have contributed to the decline of ferrets, and the other is for purposes of factoring them into the management decisions that will be necessary to conserve the species. Perhaps our repetition here of information regarding the first subject has been redundant, given the extended treatment that has been given to it by other workers. However, we feel that the salient points bear repeating, because there are still intense pressures by certain interests to continue prairie dog control on a massive basis and by whatever means that are effective. Such an approach to prairie dog management is not conducive to the restoration of black-footed ferret as a viable member of the ecosystem.

With regard to unnatural mortality in future management of ferrets, we must weigh all possible factors in taking steps to conserve the species. For example, we need a realistic appraisal of the effects that sylvatic plague has indirectly on ferrets and perhaps directly as well. In the final analysis, given the negative impacts of plague on prairie dogs, it may be that those areas in which these rodents are severely affected will have to be removed from further consideration for conserving ferrets—even ignoring any direct effects that the disease may have on ferrets themselves. Whatever such decisions may be, they should be made with our eyes wide open and our facts straight.

IDENTIFICATION

Among others, Fortenbery (1972) has provided specific information on the means of properly identifying the black-footed ferret—particularly with reference to other mustelids, such as the European ferret or polecat and the long-tailed weasel. We feel that reiteration of some points of identification are desirable, with special reference to New Mexico—as discussed below.

Distinguishing the European ferret from the black-footed ferret poses problems that may be beyond the capabilities of many observers. For one thing, the European species can have many of the field marks of the black-footed ferret—at least to the uninitiated—i.e. dark mask, and feet on an otherwise pale body (Figure 2). We are unsure as to how frequent this variant of the European ferret is, but we have seen it on occasion in the pet trade. In all of its darker variants, this species is readily distinguishable from the black-footed ferret by body color alone—this typically being brown to blackish. Where color does not distinguish the two, Fortenbery's (op. cit.) emphasis on body shape and hair length are helpful to people who have some training in mammal identification. However, we expect that most people who might see a pale European ferret would report it as a black-footed ferret.

We have very little information on the status of the European ferret in the wild in the United States, nor do we have any figures on the numbers kept or sold as pets in our

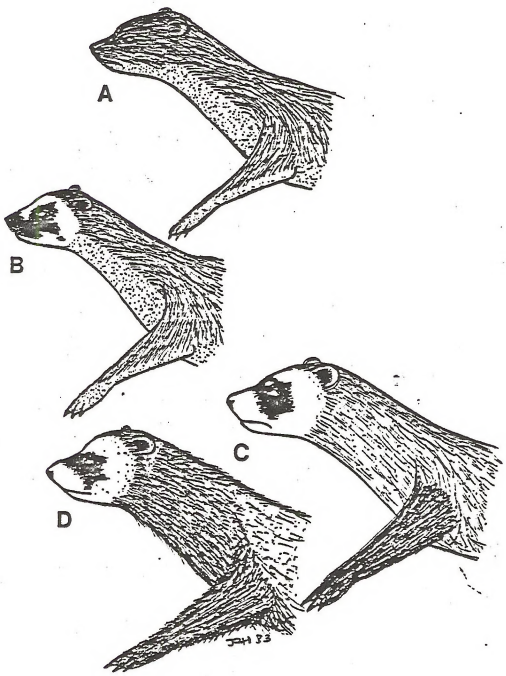


FIGURE 2. Long-tailed weasels and ferrets of New Mexico: A. "umbridled" type of weasel; B. "bridled" type of weasel; C. black-footed ferret; and D. European ferret or polecat (paler form).

region. Choate et al. (1982) indicate that a specimen was collected in Kansas as early as 1900, but we do not have information as to its being wild-taken. In New Mexico, the status of the European ferret is not documented in detail, but the species does not appear to be established anywhere here in the wild. There have been several recent instances of ferrets being found wandering about in populated areas, including in the Espanola, Santa Fe, Roswell, Albuquerque, and Las Cruces areas. In December 1981, a ferret was killed 20 miles east of Santa Rosa, Guadalupe County, where it was said to have been after chickens (T. Soapes pers. comm.). The animal was originally reported as a black-footed ferret (discussed later), but the pelt was later verified as being that of Mustela putorius (T. Best pers. comm.). The earliest testimony that we have on the keeping of ferrets in the state is from James Vaught (pers. comm.), who raised and hunted with the animals in the Clovis area in the 1960's. We understand that ferrets are still used for hunting in other states, e.g., by falconers in Colorado (Jerry Craig pers. comm.), and such would not be unexpected in New Mexico.

While European ferrets have been reported on occasion as black-footed ferrets, at least in New Mexico we believe that the greatest source of misidentification is the long-tailed weasel—especially the so-called "bridled" types (M. f. arizonensis and M. f. neomexicanus). Bridled races of this weasel are marked by having a whitish line extending across the forehead and down each cheek, essentially separating the dark dorsal coloration of the head into a "mask" (Figure 2). While different in detail from the mask of the black-footed ferret, on quick glance or to the uninitiated the resemblance between the two may seem greater than it really is.

Long-tailed weasels also differ in other respects from black-footed ferrets, as pointed out by Fortenbery (1972). For example, New Mexico races of this weasel are reddish-brown dorsally and white to yellowish or buff ventrally. These two areas of coloration are sharply demarked, contrasted to the ferret—which is rather uniform in body color. Both species share the character of a black-tipped tail, but weasels have the tail half or more as long as the body—whereas ferrets have the tail a third or less the length of the body. In addition, weasels have their foot color no darker than adjacent areas of the leg—versus blackish in the ferret.

Color, pattern, and tail/body ratios are best for distinguishing the long-tailed weasel and black-footed ferret, especially compared to size. While Fortenbery's (op. cit.) weights for weasels (7 to 12 ounces) do not overlap those of adult black-footed ferrets (20 to 40 ounces), there is overlap in length. Fortenbery (op. cit.) lists weasels as 12 to 20 inches, versus 18 to 24 in the ferret—an overlap of two inches. Under the circumstances, we feel that at least length is not reliable for distinguishing these two species—except under very favorable circumstances, e.g., if one observes a large ferret (male) or a small weasel (female). Size is also a relative character, and without some basis for comparison, it is even less reliable.

Given that bridled weasels are likely to be confused with black-footed ferrets, what means can be used to evaluate this possibility in a report? We have already discussed the matter of characters that separate the two species, but there is more that can aid in evaluation. As it turns out, the bridled forms of the long-tailed weasel are not ubiquitous in New Mexico, being found in the southern half to two-thirds of the state (Figure 3). By

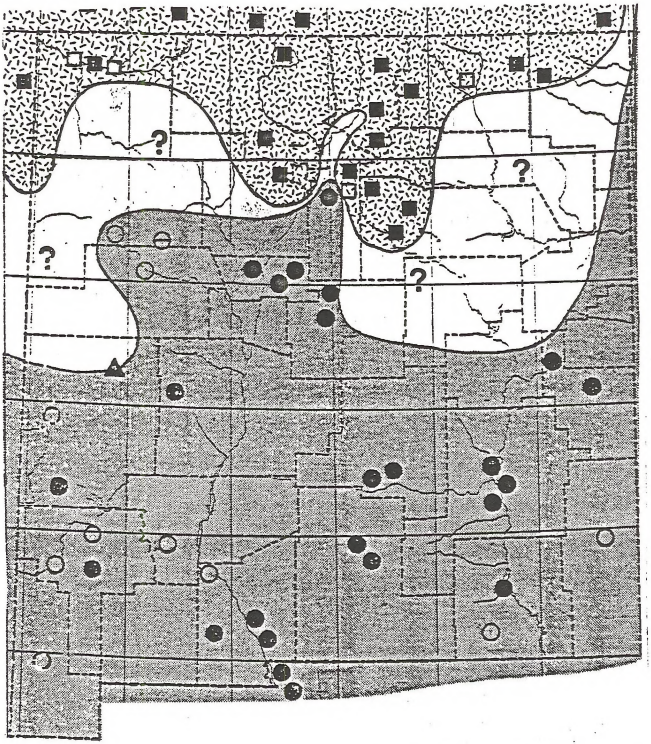


FIGURE 3. Distribution of the long-tailed weasel in New Mexico and adjacent states: unoridled type (squares and dash-pattern); bridled type (circles and stippling); and unknown or intagrades type (triangles). Solid symbols are verified and open are unverified records.

comparison, a significant area in the north is occupied by a type that is not bridled, i.e. M. f. nevadensis. While the data are not complete, what is apparent is that M. f. nevadensis is to be expected at least throughout the montane areas of the central-northern reaches of the state. This means that reports of "masked," weasel-like animals there are apt to refer to ferrets (black-footed or European), just by the process of elimination. We suspect that the unbridled race is also the type of long-tailed weasel to be found in parts of the northwestern and perhaps central-western area—although only verified to date from the Chuska Mountains region. Elsewhere in the state, the presence of bridled weasels is, and will no doubt continue to be, a problem to be contended with in evaluating reports of the black-footed ferret.

SURVEYS

Surveys for the black-footed ferret are largely rooted in the growth of environmental consciousness of the 1960's and 1970's. Unfortunately, the prime goal of such surveys, i.e., finding populations of ferrets, has largely been unattained. However, such surveys have been far from unproductive, if for not other reason than having heightened public and other concern about this species and its conservation. This is not to say that the corner has been turned toward conserving the ferret, for this is not the case. Many events transpire every year that diminish the prospects of such conservation, not the least of which is continued destruction of the prairie dogs.

Among the efforts expended in recent years as part of surveys for ferrets have been publicity campaigns conducted by federal, state, local, and private organizations. We are aware of such campaigns by the U. S. Fish and Wildlife Service overall and in the states of Wyoming, South Dakota, Kansas, Colorado, Oklahoma, and New Mexico. The New Mexico program is ongoing, and it will continue as long as hope remains that the ferret occurs and can be conserved in the state.

Besides publicity campaigns, there have also been many on-the-ground surveys of prairie dog colonies and other areas where black-footed ferrets were reported or suspected to occur. Most of the methodology employed in these surveys has been derived from the studies of ferrets in South Dakota, with modifications from various other sources—including the recent work on the species in Wyoming. In fact, the latter study has led to the recent issuance of revised survey methods (Clark et al. 1982), and these are being employed in various areas, including New Mexico. We recommend this revised methodology be accepted as the standard throughout the region in which ferrets might possibly occur. However, we feel that additional steps are needed in ferret survey activities, particularly in those cases in which prairie dog colonies are to be subject to control or other reduction—as outlined below.

First, we wish to reemphasize the point that control or other reductions of prairie dog colonies should be undertaken only as a serious exercise. This should especially be the case where the potential exists that ferrets may occur in or near these colonies. However, we also believe that "sparing" prairie dog for their own sake is a valid goal, even if these animals are competing with other interest groups for forage, land, or related commodities. In particular, we feel that prairie dogs have rights under the multiple use doctrine to occupy public lands, side-by-side with grazing, recreation, and other such

activities. Nonetheless, there will be times in which some control of prairie dogs can be justified, and it is these eventualities that concern us at the moment.

Given that adequate justification is made to control a population of prairie dog, (say) on public land and/or using public funding/services, what steps should be taken to safeguard any ferrets that may be present in the area? First, it should be assumed that any prairie dog town could harbor ferrets, and therefore no control operation should be undertaken without this possibility having been considered. To do otherwise is to beg the issue as far as locating and conserving ferrets. If we are going to beg the issue, then it means that these goals are not being taken seriously. And, if we are not going to take them seriously, then perhaps we should not pursue them at all.

In our view, proper consideration of any proposed control of prairie dogs should involve at a minimum an examination of as many as possible, and at least a representative segment, of the burrows for ferret "sign"—i.e. scat, tracks, prairie dog remains, trenches, plugged burrows, and so on. Absence of any such sign or other evidence of ferrets may be sufficient justification to allow control to proceed in some instances, such as in small prairie dog areas in urban areas. Control at this juncture would be most justificable in colonies that were of recent origin and/or remote or disjunct from other colonies.

In most other instances, we are of the opinion that control operations should not proceed without further steps to safeguard any ferrets that may be present. This is especially the case on any public lands and/or where public funding/services are involved. In addition, even without public involvement, we think such steps should be voluntarily taken on private lands—especially when large numbers of prairie dogs are involved, either as blocs or in the aggregate. The likelihood is, the larger the numbers of prairie dogs, the more important the area is apt to be as an actual or potential resource for ferrets.

Moving from the extreme of prairie dog areas that are of low potential for ferrets to ones that are high, for the latter we would recommend a much more complicated approach to control. First, we suggest that the procedures outlined by Clark et al. (1982) be followed, with diligent searches of significant numbers of prairie dog burrows for sign. Should sign be found, then continue to follow those procedures, and advise authorities in the New Mexico Department of Game and Fish and the U.S. Fish and Wildlife Service. On the other hand, if no ferret sign is found, then prepare to implement a "refugial" program.

The refugial program is a concept that we have devised by which control in high ferret-potential prairie dog areas is allowed to proceed, as long as protected enclaves of the rodents are left behind. To accomplish this, prairie dogs in and near the areas to be controlled are first mapped and the densities of these rodents are computed. Following mapping and computation of acreages and densities of prairie dogs, at least one refugial area is to be selected in which at least no immediate control of prairie dogs will be undertaken. The sizes and numbers of the refugial areas to be established will depend on the acreages/densities of prairie dogs in the area and on future plans with regard to any ferrets that might be located.

As discussed earlier, Stromberg et al. (1983) have estimated population sizes of prairie dogs needed to sustain female ferrets and their young for a year. We recommend

that these findings be adopted for establishing minimum refuge sizes in conjunction with prairie dog control in New Mexico. In particular, we believe that the most acceptable figure for these annual needs is that of a population of at least 766 black-tailed prairie dogs per ferret female/litter per year. Based on an average density of 6.1 prairie dogs per acre, this means that about 125 acres of these animals would be needed to sustain this complement of ferrets. The actual acreage would obviously depend on the actual prairie dog densities there, and this would need to be calculated in each control situation.

In Gunnison's prairie dog, we can assume that a larger population would be necessary to maintain a female ferret and her young—given the smaller size of the former species. Scheffer's (1947) weights of Gunnison's prairie dog can be converted into a median value of 563 g, which is about 25% less than that attributed by Stromberg et al. (op. cit.) to the black-tailed prairie dog. For simplicity's sake, let us also increase the needed population size in Gunnison's by 25% over that of the median required in black-tailed prairie dogs, i.e., from 766 to 957 animals. In terms of intrinsic rate of increase, let us accept Strombert et al.'s (op. cit.) figure for other prairie dogs, i.e., 1.50. Finally, given that densities of Gunnison's prairie dog (Lechleitner el al. 1980) appear to be similar that used by Stromberg et al. (op. cit.) for the white-tailed prairie dog, let us use the latter value, i.e., 1.6 per acre. Thus, one might expect that a proper refugium of Gunnison's prairie dogs would be on the order 598 acres, which is, again, a general figure and subject to specific calculation.

Our point here is not so much to establish a fixed procedure, as it is to develop a broad concept. We feel that the refugial approach to prairie dog management would allow control to proceed even in areas of high ferret potential, while assuring that adequate habitat remains for ferrets. The leaving of areas of uncontrolled prairie dogs in the wake of control operations is the most feasible approach that we can see to the problem—given that the pressures to control these rodents persist on one hand and the need to safeguard potential ferret habitat exists on the other hand. The refinement of this approach will require both the interest and coordination of all concerned, and many details will need to be worked out in the process.

Among the details that we see needing attention is that concerning the acreages of refugial areas that should be left versus the acreages that are controlled. In this regard, we feel that on public land at least 25% of all prairie dogs should be left in an area that is controlled. Furthemore, if a control proposal for an area of high ferret potential does not contain at least enough acreage for maintaining the recommended population sizes of prairie dogs, then perhaps that area should not be controlled at all.

We can see situations in which lesser populations of prairie dogs might be acceptable in refugial situations. For example, if it is established that any ferrets in a proposed control area are to be captured and removed, then obviously a smaller refugial area could be justified. How much smaller the area could be would depend on the speed with which the ferrets were to be removed. However, given the uncertainties of such an operation, we would not wish to see a refugial population of prairie dogs that would provide less than a three-month prey supply for the ferrets.

In addition, any capture and removal of ferrets would have to be planned in advance,

preferably involving a "secured" population of prairie dogs. By secured, we mean a population that is: (1) large enough to support several ferrets, (2) protected against control and other man-related destruction, (3) with adequate habitat, and (4) otherwise assured a future. At least with regard to Gunnison's prairie dog, we would also recommend as a prophylactic measure that insecticides be used periodically to kill the fleas that transmit plague.

Even if there is no plans to capture and remove any ferrets that might come to light after the control of prairie dogs, the refugial areas should be surveyed to determine if ferret actually do occur in or near them. In theory, the collapse of adjacent prairie dog populations should attract ferrets to refugial areas, thus making detection less difficult than it otherwise would be. Such surveys should start soon after control has been effected, and they should include at least some examination of controlled areas as well as the refugia.

The refugial areas can also serve as assay sites in the event of additional control being proposed for prairie dogs in an area. In the event that no ferret sign is detected in refugial areas, then one could more easily justify further bouts of control. In cases where total elimination of prairie dogs is the goal, e.g., on private lands, the refugial areas themselves could be progressively eliminated by control--using the remaining ones each time for assaying for ferrets. Should ferrets be detected, then capture operations could ensue prior to final control operations.

We have emphasized two extremes in terms of areas that are proposed for prairie dog control, i.e., those with very low and those with very high potential as ferret habitat. Many areas will fall in between, and there may well be procedural questions in applying a refugial program as part of a control operation. Our recommendation is that, whenever possible, the refugial approach be used--even on private land. In this way, ferrets can be conserved, even if we do not know that they are present. Contrasted to the current approach to prairie dog control, we think that the ferret has everyting to gain and relatively little to loose under our recommendation.

As a final point, we wish to emphasize the need to use the most benign agents possible in controlling prairie dogs--and not just in areas with higher potential for ferrets. Grain treated with zinc phosphide is a preferred agent for killing prairie dogs (Tietjen 1976), and this should be placed well down in the burrows where birds or other surface-dwelling species cannot reach it. Strychnine grain is a substitute, but it is less safe and may cause secondary poisoning. Under no circumstances should compound 1080 or similar agents be used, and we are also opposed to gassing of prairie dogs. Finally, control should be done in early spring if possible, as this period produces more effective results and is less of a threat to litters of ferrets and most other wildlife.

EVALUATION OF REPORTS

The section is of an introduction into the problems of evaluating records of the black-footed ferret. The fact is, most people who report ferrets are neither trained observers nor biologists, and they therefore may not obtain the information that is most critical for proper evaluation of a record. Even many biologists confront this problem, as

they may lack a priori information that would allow them to distinguish a black-footed ferret from some other species. The problem is compounded by all those qualities that have made gathering information on this species so difficult, plus other factors that may be attendant to an observation, e.g., poor lighting, distant or quick viewing, and so on. Regardless of the problems, it is essential that an effort be made to evaluate records as objectively and as thoroughly as possible, preferably through interviews with the people who observed the purported ferrets or their "sign.".

For our purposes, we have adopted a probability framework for evaluating ferret records from New Mexico. We cannot claim utter objectivity in our evaluations, nor are all of the categories necessarily equivalent. Nonetheless, we have tried to apply the criteria uniformly, and therefore we believe that, relative to each other, our evaluations are reasonably consistant. The categories are as follows:

1. Positive. These are records supported by extant specimen material, preferably that is housed in a museum collection. Also included here are specimen records that were verified by an acknowledged expert, even if the material has been lost or destroyed.

2. Highly probable. These are records by persons who have very good backgrounds in wildlife identification and/or who provided highly convincing details in support of the records.

3. Probable. Similar to Category II, but these are records from persons whose backgrounds are not as good and/or supporting details are not as convincing.

4. Possible. Similar to Category III, but these are records from persons whose backgrounds and/or details are at a lower level.

5. Indeterminate. These are records from persons whose backgrounds and supporting details are unavailable to us and therefore which cannot be properly evaluated.

6. Questionable. These are records from persons with inadequate backgrounds in wildlife identification and/or whose details supporting the reports are flawed—typically to the point of suggesting some species other than the black-footed ferret.

7. Erroneous. These are records in which the physical evidence supporting the report has proven to be of some species other than the black-footed ferret.

We also apply other considerations in evaluating reports of black-footed ferrets from New Mexico, including such things as corroboration by virtue of the presence or absence of other records from the same time-interval or area, sources of confusion, other physical or descriptive evidence (including "sign"), and so on. Photographic materials are evaluated the same as other physical evidence, so long as they are accurately labeled as to the place and date of origin.

We assign all records of black-footed ferrets from New Mexico a numerical identifier for ease of reference. This identifier consists of the year of record, followed by

the sequential number that record represents for the year in question. For example, the first report that we receive of a ferret in 1984 would be identified as 1984-1, the second as 1984-2, and so on. Where a span of years is indicated, e.g., 1943-1946 or 1960's, we use the first year of the sequence, i.e., 1943 and 1960, respectively. We assign identification numbers to all records, whether positive, erroneous, or otherwise. Erroneous and questionable records are valuable in offering insights into the sources of confusion in ferret identificaton, a problem that we will continue to seek progress in solving. Records covered in this report are current as of September 15, 1983, and the period covered is through December 31, 1982.

THE STATUS OF PRAIRIE DOGS IN NEW MEXICO

Two species in the genus Cynomys occur in New Mexico, the Gunnison's prairie dog in the north and west and the black-tailed prairie dog in the east and south (Figure 4). Discussion of these species and their status in the state is critical to the understanding of the status of the black-footed ferret here. However, our treatment of prairie dogs will be slanted toward the ferret, and it is not meant to be a complete treatise on the subject.

PREHISTORIC DISTRIBUTION

PALEONTOLOGICAL RECORDS

Several late Pleistocene to early Recent records of prairie dogs have accumulated from New Mexico and adjacent states, as compiled and kindly conveyed to us by A. H. Harris (ms.). We have plotted the records in Figure 5, where one notes that most occurrences rather parallel the historic distribution of prairie dogs in the state and adjacent areas (Figure 4). However, there is a notable departure—that being the presence of the subgenus Leucocrossuromys well east of its present range, in both the extreme northeast and the extreme southeast. The records in question are in three cases applicable to Gunnison's prairie dog, one considered definite and the others provisional. The fourth record is identified to the subgeneric level only—albeit circumstantial evidence would suggest that this same species is also involved there as well. The definite record is from the Mesa de Maya, Las Animas County, Colorado—just north of Union County, New Mexico. The two provisional records are from Culberson County, Texas—one from Lower Sloth Cave and the other from Williams Cave. The subgeneric level record is from Dry Cave, Guadalupe Mountains, in Eddy County, New Mexico. The dates on these records are Sangamonian (last interglacial) in Colorado and 11,140+/-320 to 14,470+/-250 years before the present—BP—(early Recent-late Wisconsinian) in New Mexico and Texas.

These findings indicate that leucocrossuromydid prairie dogs—presumably Gunnison's—at one time ranged well east of their present range in New Mexico and adjacent areas. This would have been during a climatic period that was less than fully pluvial yet probably moister and cooler than at present. This implication is in agreement with a considerable body of other evidence that points to an expanded range of montane elements into eastern New Mexico and adjacent areas during the geological times indicated above. The Colorado record is perhaps 80 miles east of the present range, while the others are nearer 180 miles southeast of it.

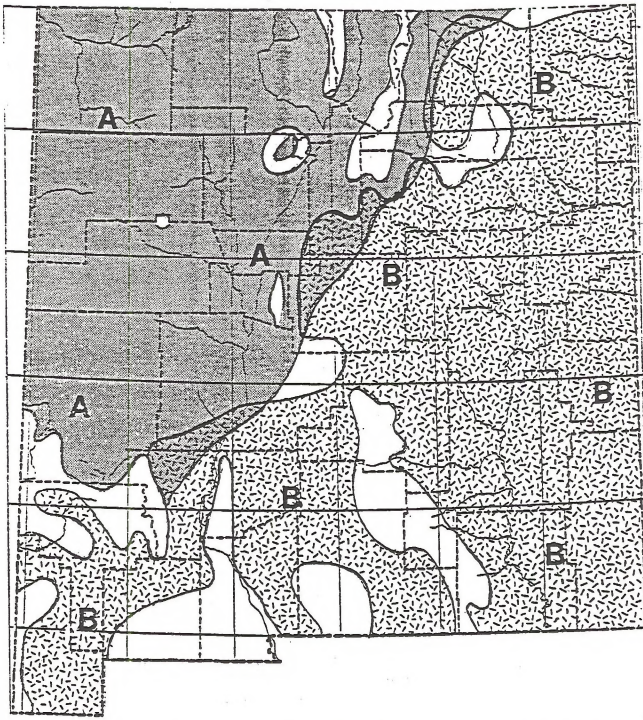


FIGURE 4. Historic distribution of prairie dogs in New Mexico: A. Gunnison's prairie dog; and B. black-tailed prairie dog. (Based mainly on Hollister 1916; Bailey 1932; and Findley et al. 1975.)

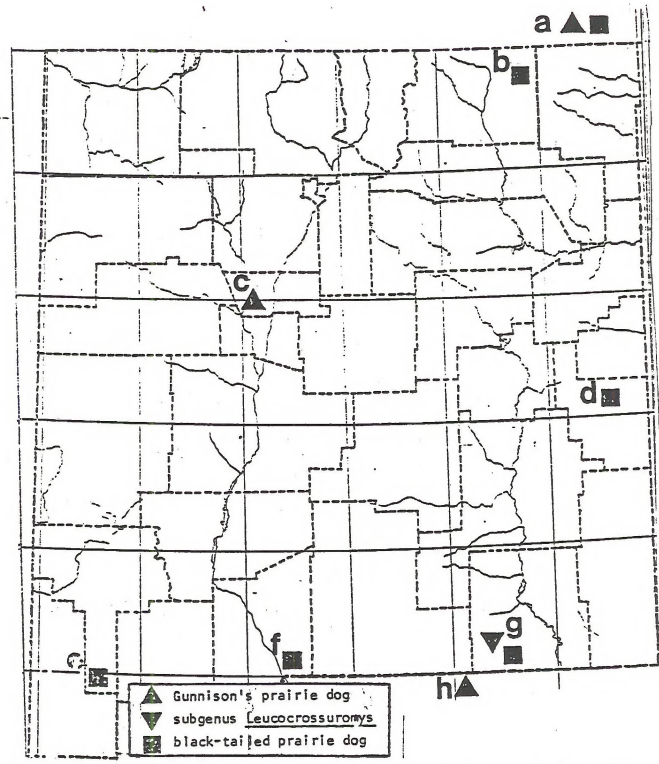


FIGURE 5. Prehistoric records of prairie dogs from New Mexico and adjacent states: a. Mesa de Maya; b. Folsom site; c. Isleta Caves; d. Blackwater; e. Howell's Ridge; f. Conkling Cavern; g. Burnet and Dry caves; and h. Williams and Lower Sloth caves. (Data from A. Harris ms.)

THE BLACK-FOOTED FERRET IN NEW MEXICO

By

JOHN P. HUBBARD AND C. GREGORY SCHMITT

Endangered Species Program
Department of Game and Fish
Villagra Building
Santa Fe, New Mexico 87503, USA

The paleontological records of black-tailed prairie dogs from the New Mexico area are essentially what one would expect for the dates and localities that are involved. Perhaps the most interesting records are those from the southwestern part of the state. The first of these is from Howell's Ridge Cave in Grant County, where deposits are dated from 2470+/-120 to 13,460+/-220 years BP. This interval extends from the early Recent essentially to the present, and it points to an extended, post-Wisconsinan existence of this species in that part of New Mexico. Another, probably contemporary record—provisionally of this species—is from Conkling Cavern in Dona Ana County, New Mexico.

That the black-tailed prairie dogs occurred even farther west during this period is evidenced by remains of the species in Ventana Cave, Pima County, Arizona—dated 11,300+/-1200 BP. What this and the above records suggest is that this species occurred westward into southwestern New Mexico, southeastern Arizona, and undoubtedly adjacent Mexico at least at the close of the Wisconsinan pluvial epoch—probably as drier and warmer conditions returned to the lower elevations of the region. Pluvial epoch occurrences to date are known only from farther east, notably Dry Cave in Eddy County, New Mexico—dated 29,290+/-160 BP. Interestingly, as discussed below, this prairie dog may have died out in most of southeastern Arizona later in the Recent period, as will be discussed below.

ARCHEOLOGICAL RECORDS

This aspect of the status of prairie dogs will not be explored here, as current resources do not permit us to investigate it on a meaningful scale. In part, the references to prairie dog remains are scattered through a large volume of literature, some of which is rather obscure and difficult to obtain. In addition, proper identification of animal remains in the archeological literature is, at times, open to question, and we suspect this is the case for prairie dogs. We do contemplate investigation of this interesting aspect of prairie dog status in New Mexico in the future.

EARLIER HISTORIC DISTRIBUTION AND STATUS

Although the written record for this period extends back to the sixteenth century in New Mexico, the first meaningful information on prairie dogs dates from the middle of the nineteenth century. However, by the latter time there had already been a number of ecological impacts on the area that could very well have affected the status of prairie dogs here. Besides being taken as food by people of that and the preceding eras, prairie dogs and their habitat in the Southwest were no doubt affected by such things as agriculture, construction of settlements, wood-cutting, mining, and especially by the grazing of domestic and feral livestock.

In regard to grazing, such early workers as Abert remarked on the numbers of wild horses present on the northeastern plains of New Mexico in 1845 (Galvin 1970), as well as the numbers of sheep and other livestock farther west in 1846-1847 (Galvin 1971). By those times, there had been some three centuries of European occupancy of the state, much of which was accompanied by livestock raising. Overgrazing was no doubt a feature of many areas near settlements, especially by the mid-nineteenth century. Further afield, livestock impacts may also have been significant, especially from feral herds of

horses and cattle. Grazing, especially overgrazing, may actually promote the spread of prairie dogs (e.g., Koford 1958), as livestock use may reduce vegetation to levels that are more acceptable to or even preferred by these rodents.

Given that the historic record of prairie dogs in New Mexico begins too late in time to necessarily represent their "primal" status, what do we know of these animals from the middle 1800's onward? What we know is this: in areas visited by such workers as Abert (op. cit.), Gregg (in Kendall 1929), Kennerly (in Baird 1859), Whipple (1856), and Woodhouse (1853) in the period 1841 to 1853, prairie dogs were not reported anywhere in New Mexico where either archaeological records or later historic reports would not lead one to have expected them. However, the record is admittedly sparse, and prairie dogs were primarily reported in the Canadian Basin of northeastern New Mexico and in the Mexican border region.

With regard to the Mexican border region, it is not clear just how extensive the range of prairie dogs there was. C. B. Kennerly (in Baird 1859:39-40), in passage in 1855 from the El Paso, Texas area to Tucson and beyond, stated that the animals were observed ". . . west of the (Rio Grande) . . . as far a the Sierra Madre . . . there was a very large extent of country covered with their burrows. After leaving this valley, in travelling westward, we did not again observe the 'prairie dog'." Kennerly's "Sierra Madre" was probably the San Luis Mountains of Mexico, just south of Hidalgo County, New Mexico. The San Luis Valley extends from Mexico northward into Hidalgo County, and it becomes the Animas Valley in that county, west of the Animas Mountains. That the black-tailed prairie dog was indeed observed there by Kennerly is verified by a specimen taken at San Luis Spring, Hidalgo County, by J. H. Clarke in May 1855 (Baird op. cit.).

It is notable that in the reach along the Mexican border between Hidalgo County and El Paso, there appears to be no specific record of prairie dog, i.e., in the southern parts of Luna and Dona Ana counties in New Mexico (e.g., Findley et al. 1975) or in adjacent Chihuahua (Anderson 1972). Mearns crossed that stretch in 1892, and he indicates that, after leaving El Paso, prairie dogs were next encountered at Dog Spring—named, he says, for this animal! This is very near the area where these animals were first specifically noted by Kennerly—i.e., southern Hidalgo County. From this we conclude that the black-tailed prairie dog was absent in the reach between El Paso and Hidalgo County. However, the latter population was perhaps connected eastward through the Grant, northern Luna, Sierra, and Dona Ana counties to populations in the Tularosa Basin and beyond. This suggests a distribution in the more elevated grasslands of the southwestern New Mexico and adjacent areas, with the species being rare or absent in more desert-like habitats.

Also interesting is the statement by Kennerly (op. cit.) that prairie dogs were not seen west of Hidalgo County, i.e., in southeastern Arizona. Corroboration of this 1855 view comes from J. G. Bourke (in Bloom, 1934:59), who traversed the region just north of there—between the present Hatch (Dona Ana County) area and Tucson—in the period 1869-1875. Bourke said that "in s.w. New Mexico, 'prairie dogs' were not unusual. In Arizona, they are scarcely ever seen and only along the eastern border." Mearns (1907:342) also quotes Bourke to the same effect, i.e., ". . . the prairie dog . . . for some reason not understood by me, does just cross over the New Mexico boundary (into Arizona) at Fort Bowie . . ."

By 1885, Mearns (op. cit.) reported "immense colonies" of black-tailed prairie dogs in parts of southeastern Arizona, including as far west as Benson on the San Pedro River. Other colonies were seen in the Sulphur Springs Valley and at Willcox, Dragoon Summit, and apparently south of the Pinaleno Mountains—but doubtfully at "the junction of the Gila and Salt rivers." In 1892 and 1893, Mearns (op. cit.) took 19 specimens of this prairie dog on the San Pedro River at the Mexican border. These 1885-1893 records are in stark contrast to the absence of reports of Kennerly (op. cit.) in this general area in 1855 and by Bourke (op. cit.) in 1869-1875.

If one accepts the data from southeastern Arizona at face value, it appears that sometime between 1869-1875 and 1885, the black-tailed prairie dog expanded its range considerably westward in the area. If this is an accurate assessment, then one is tempted to look for an explanation. Assuming the expansion of these prairie dogs there was widespread, the explanation must be of sufficient scope to apply widely as well. Other than a possible climatic shift, perhaps the most logical explanation is that livestock grazing opened up areas to prairie dogs that were not previously available. The latter explanation is supported by several pieces of information, including the fact that livestock numbers did increase notably in the region beginning in the 1850's (York and Dick-Peddie 1969). As for any climatic shift, our information for the period between 1851 and 1886 is that no notable change occurred that would seemingly have been conducive to the spread of prairie dogs. For example, annual precipitation in the period averaged 8.6+/-2.8 inches at Las Cruces (Fassig 1932), and a chi-square yields a probability of 0.75—indicating no significant deviation.

Our point here is not to indict grazing or other man-associated impacts with the spread of prairie dogs, although this prospect is one that needs a larger audience. Rather, we are interested in knowing as much as possible what the primal status of prairie dogs might have been in the Southwest, for we think that such an understanding is important in considering the status of the black-footed ferret in the region. If, as would appear to be the case here, prairie dogs were able to expand relatively rapidly into some areas that were not previously occupied, what was the response of ferret populations? We suspect that ferrets followed expanding prairie dog populations, but the potential to increase in these carnivores was perhaps not sufficient to keep up with expansions in the range of the rodents. If this were the case, then possibly there were areas into which ferrets were not able to expand—including possibly southeastern Arizona.

Even in southwestern New Mexico, where black-tailed prairie dogs had apparently persisted for millennia, until recently we had no report there of the black-footed ferret. The absence of ferret reports in that area raised intriguing questions. For example, was it possible that ferrets either did not reach Sub-Mogollon southwestern New Mexico or that they died out there, perhaps prehistorically—even though prairie dog persisted? If they died out, why did they not spread back into the area—given the apparent continuum of prairie dogs populations there with more easterly/northerly ones that contained ferrets? Did the absence of ferrets there, in fact, mean that southern populations of black-tailed prairie dogs had been disjunct and therefore "out of reach" for ferret reoccupancy?

The "scenario-making" concerning the presumed absence of black-footed ferrets in the Sub-Mogollon Southwest was a tenuous exercise, particular now in view of our having

received an early report of a ferret from there. Scenarios based on the absence of ferret records in an area represent an extreme application of negative evidence, and we believe that exercises of this sort must clearly be identified as speculative and must not be allowed to substitute for more objective approaches—especially in making management decisions. It is one thing to ask esoteric questions based on negative data such as these, but one should never act in ways that might negatively impact ferrets on such bases, e.g., to control prairie dogs without prior surveys.

To return to the black-tailed prairie dogs of southwestern New Mexico, we next cite Bailey's (1932:124) rather vivid description of the Animas Valley in 1908 as "an almost continuous prairie dog town for its whole length and breadth." He estimated that as may as 6,400,000 prairie dogs occupied 1,000 square miles in that region, presumably largely spurred by the Animas Valley observation. Bailey (op. cit. 123-125) also enumerated occurrences of the species from the latter area northward to Cliff and Silver City in Grant County in the period 1892-1908 and Lake Valley in Sierra County in 1909. By comparison, Alexander (1932:302) in 1931 reported seeing prairie dog towns totalling only about 50 acres in the Animas Valley, and she heard of another small colony in the Playas Valley—east of there. This is a marked contrast to the situation only 23 years earlier, and in Arizona the species was bordering on extirpation by 1931 (Alexander, op. cit.).

By 1955, black-tailed prairie dogs were so scarce in Sub-Mogollon southwestern New Mexico that Findley et al. (1975:132) were never able to find living animals there. However, small numbers persisted into the late 1950's and early 1960's, at least in the Summit area of Hidalgo County and the Separ to White Signal areas of Grant County (A. Bayne et al. pers. comm.). These animals were soon exterminated, and as of now the only black-tailed prairie dogs that we know of west of the Rio Grande are in the northwesternmost Chihuahua—where seen commonly in the Janos area and westward as recently as September 1983 (G. Monson pers. com.).

The extermination of any population of a species is a sad event, because it means that biological diversity is reduced and the earth is poorer as the result. Regardless of questions of whether a species is "good" or "bad" for man's interests, it is short-sighted to seek such extermination—much less to achieve it. A population of prairie dogs that has existed in an area for over 13,000 years deserves a better fate than to have been extirpated in two states and surviving without protection in a third area. This contention would be true even in the absence of the fact that this population has been distinguished as a separate race, C. l. arizonensis, as discussed later.

Farther east, the historic range of the black-tailed prairie dog has also shown marked reduction, including apparent extirpation in several counties west of the Pecos Basin (Findley et al. 1975:131-132). Bailey (1932:119-121) gives records of this species from several areas in which there seem to be no recent reports, including near Pecos (San Miguel County) in 1903, the San Pedro area (Santa Fe County) in 1889, the east side of the Manzano Mountains (Torrance County) in 1903, Capitan Mountains foothills (Lincoln County) in 1903, Chloride (Sierra County) in 1909, and the San Andres (=Organ?) Mountains (Dona Ana County) in 1903.

Findley et al.'s (1975:131) area of "probable extirpation" in Lincoln and Otero

counties is premature for the moment, as small populations of black-tailed prairie dogs do persist there. These are classed as endangered by the New Mexico Department of Game and Fish—Game Commission Regulation No. 624, July 22, 1983, plus earlier regulations—as the so-called "Tularosa" prairie dog (see Taxonomy section). Otherwise we know of no other populations of black-tailed prairie dog that persist in Findley et al.'s (op. cit.) area of probable extirpation.

Records of Gunnison's prairie dog over the historic period are many fewer than those of black-tailed prairie dogs. This is probably due to the generally less conspicuous nature of Gunnison's prairie dog towns and fewer observers having passed through areas in which the species occurs. Bailey's (1932:125-131) range for the species is similar to today's, although overall numbers have been considerably reduced and some populations have apparently been extirpated. As an example of the latter, we are unaware of any recent records of the species in the Fair View (= Winston) area (Sierra County), where E. A. Goldman (in Bailey op. cit.:128) indicates the species was "abundant and generally distributed" in 1909. Interestingly, Goldman was told by local cattlemen that the prairie dogs had been in the area for "only five years prior to that time," suggesting that range expansions also occurred at times in this species.

PRESENT DISTRIBUTION AND STATUS

The present ranges of the black-tailed and Gunnison's prairie dogs are shown in Figure 6. We estimate that the overall range of the black-tailed prairie dog in New Mexico has been reduced by one-fourth, contrasted to no overall reduction in Gunnison's prairie dog. However, if accurate data were available on the actual areas occupied now versus previously, the ranges of both species would show vast reductions.

Bodenchuk (1982) has recently attempted to determine present county acreages of prairie dogs in New Mexico, using questionnaires mailed to some 6941 agricultural producers statewide. Of the 31 counties surveyed, Dona Ana, Eddy, Grant, Hidalgo, Lincoln, Luna, Otero, Sierra, and Union county respondents reported no acreages occupied by prairie dogs. As already discussed, we believe that prairie dogs (black-tailed) have been extirpated all but four of these counties, hence the zero-occupancy for them agrees with our data. In the cases of Lincoln, Otero and Union counties, we know that black-tailed prairie dogs are still present, and we suspect the same is true of Eddy County. In Sierra County, where the black-tailed prairie dog appears to have been extirpated, the zero-occupancy report belies the persistence of Gunnison's prairie dogs there. These discrepancies may reflect in part a failure of the survey to reach all of the agriculture producers who did indeed have areas occupied by prairie dogs. However, this explanation would not seem to apply in areas were substantial numbers of questionnaires were sent and where prairie dogs remain somewhat widespread, e.g., Union County.

Bodenchuk (op. cit.) summarized his "usable positive" data by county, using both the reported acreages of prairie dogs and those extrapolated from the ratio of non-respondents to respondents. In order to convey these findings graphically, we have plotted the extrapolated acreage for each county as a percentage of the total county acreage (Figure 7). Even accepted at face value, the level of prairie dog occupancy on a county-by-county basis is quite low, ranging from zero (see above) to 0.98% (Roosevelt County).

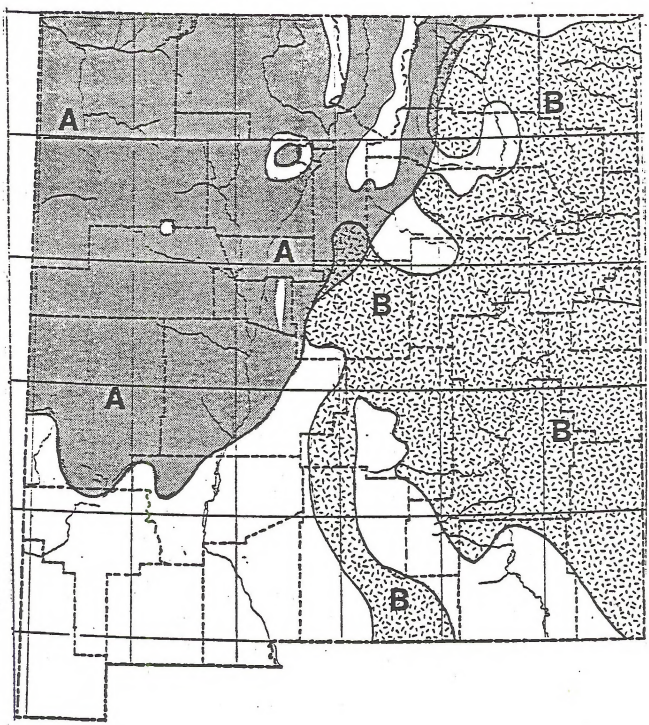


FIGURE 6. Present distribution of prairie dogs in New Mexico: A Gunnison's prairie dog; and B. black-tailed prairie dog.

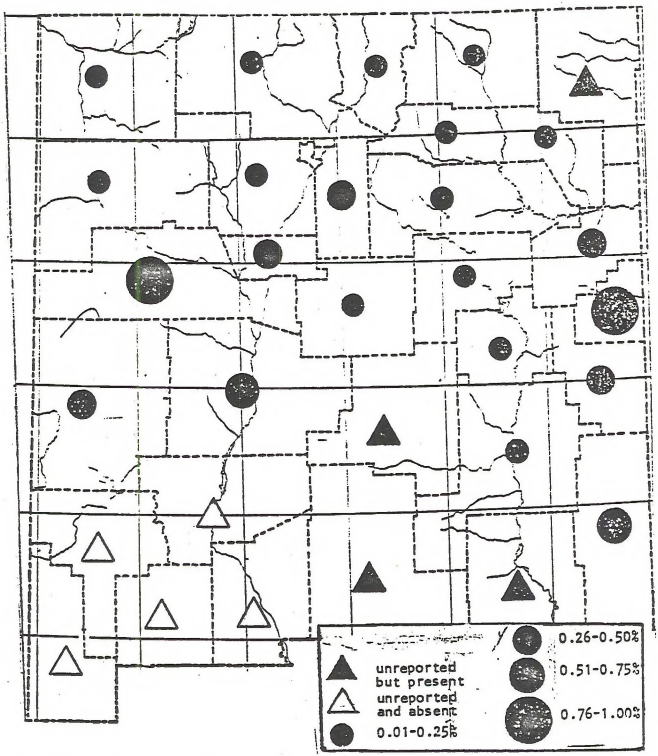


FIGURE 7. Present densities of prairie dogs in New Mexico, shown as percent occupancy of the total acreage of each county. (Data from Bodenchuk 1982.)

Statewide, the extrapolated level of occupancy is a miniscule 497,012 of the state's 77,866,240 total acres, which translates to 0.64% overall. By comparison, in 1919—following several years of prairie dog control—the area occupied by prairie dogs in New Mexico was estimated at 11,951,000 acres, or 15.3% (Shriver 1965).

TAXONOMY

Two species of prairie dogs, each with two subspecies, have been attributed to New Mexico; these are as follows:

1. a. Cynomys ludovicianus ludovicianus (Ord.)
   This is the nominate form of black-tailed prairie dog, and the type locality is the Upper Missouri River (Hall 1981:411)—probably in South Dakota or Nebraska (Hansen 1977).

   b. Cynomys ludovicianus arizonensis Mearns
   This is the "Arizona" prairie dog, and the type locality is Point of Mountains, near Willcox, Cochise County, Arizona (Hall loc. cit.).

2. a. Cynomys gunnisoni gunnisoni (Baird)
   This is the nominate form of Gunnison's prairie dog, with the type locality Cochetopa Pass, Saguache County, Colorado (Hall op. cit:414). This species is sometimes referred to in our area as the "white-tailed" prairie dog, but that name properly refers to Cynomys leucurus.

   b. Cynomys gunnisoni zuniensis Hollister.
   This is the "Zuni" prairie dog, and the type locality is Wingate, McKinley County, New Mexico (Hall op. cit:415).

The most comprehensive taxonomic study of prairie dogs to date is that of Pizzimenti (1975), who recognizes five species and two subgenera in the genus Cynomys. As indicated elsewhere, Cynomys ludovicianus is a member of the nominate subgenus (i.e., Cynomys), while C. gunnisoni is in the subgenus Leucocrossuromys. The two New Mexico species are distinct from each other in several characters, including in chromosome number—i.e., 2n = 50 in the black-tailed and 2n = 40 in Gunnison's prairie dog. The following key demonstrates separation of the two species (based on data from Armstong 1972; Bailey 1932; Hollister 1916; Hall 1981; Pizzimenti and Hoffman 1973; Pizzimenti 1975):

1. Tail tipped with blackish to black, more than one-fifth the total body length—72 to 115 mm in adult; pelage typically darker, but lacking darkened area in the eye region; jugal bone heavy and thick (**black-tailed prairie dog.**)

1. Tail tipped with grayish to whitish, less than one-fifth the total body length—39 to 68 mm in adults; pelage typically paler, with area above and behind eye darker than adjacent region; jugal bone weak and thin (Gunnison's prairie dog.)

BLACK-TAILED PRAIRIE DOG

The two subspecies of black-tailed prairie dog have been the subject of several studies (e.g., Hollister 1916; Pizzimenti 1975; Hansen 1977; Chesser 1981). Whether one recognizes two forms or not, all workers seem to agree that C. l. arizonensis is only slightly differentiated from the nominate form. A recent study by Hansen (op. cit.) provides evidence that arizonensis is separable from the nominate form by the former's narrower mastoid breadth. More importantly, Hansen (op. cit.) reported that C. ludovicianus populations from the Tularosa Basin (Lincoln and Otero counties) in New Mexico are even more distinct, differing from the nominant form in being paler and with the mastoid breadth narrower and the cranial depth shallower. This "Tularosa" prairie dog is said to differ from arizonensis in being paler and with a shallower cranial depth.

More recently, Chesser (op. cit.) has investigated the matter of differentiation in C. ludovicianus from New Mexico and adjacent areas—using both genic and morphometric analyses. Unfortunately, neither this study nor those of Hansen (op. cit.) and Pizzimenti (op. cit.) are superimposable in all respects, and therefore comparing their results is difficult. For example, only Hansen (op. cit.) examined pelage color, including in near-topotypical material of both ludovicianus and arizonensis. On the other hand, only Chesser (op. cit.) did genic comparisons, and in his cranial comparisons he included many more populations from eastern New Mexico than did Hansen (op. cit.). Unfortunately, Chesser (op. cit.) did not study near-topotypical of the named forms, either genically or cranially. As for Pizzimenti (op. cit.), he did include near-topotypical material in his morphometric analyses, but his methods of aggregating of samples and characters may obscure differences. With this all said, let us attempt to interpret geographic variation in Cynomys ludovicianus as it pertains to New Mexico.

In any analysis of geographic variation within a species, it is important to begin with samples of specimens from the smallest, most homogeneous areas possible—in hopes of maximizing similarities per unit area. Any aggregation of such samples into larger units should be done on the basis of proven similarities among them. In applying this concept to southwestern Cynomys ludovicianus, a logical place to begin is at the type locality of C. l. arizonensis, i.e., Willcox, Cochise County, Arizona (Mearns 1890:305). The researcher to do this best is Pizzimenti (1975), who measured eleven such specimens for 15 cranial and three external characters in his study of prairie dogs. He multivariately compared this sample with 72 others of prairie dogs, 26 of which were C. ludovicianus.

In the distance matrix produced by these comparisons, Pizzimenti (op. cit.) shows that the Willcox sample is most similar to one from Wyoming. These two are, in turn, about equally similar to other diverse groups from throughout the range of the species. By contrast, the most distinctive population is one from Chihuahua, followed by one from Brewster County, Texas. In the correlation matrix, Pizzimenti (op. cit.) shows that the Willcox sample stands apart, being exceeded in distinctiveness only by an aggregate of samples from the nearby Huachuca Mountains and the Animas Valley of New Mexico, plus others from Boyd County, Nebraska and Yellowstone County, Montana. In this analysis, the Chihuahua sample sorts into a broadly diverse group, and thus it does not stand apart. Brewster County is the most distinctive of all, being aggregated not with the black-tailed prairie dog but with the Mexican prairie dog!

The misallocation of the Brewster County sample in Pizzimenti's (op. cit.) analyses is not unique, as both the distance and the correlation matrices incorrectly allocate samples of other species as well. What may be happening is that Pizzimenti's array of taxonomic characters is not necessarily the best for discriminating among species of prairie dogs. It may be that fewer of the characters in this array, or some of them plus others that were not used (e.g., color or pattern of pelage), would yield better results. Whatever the case, if Pizzimenti's analyses fail in the aggregation of samples into their proper species, then by extension we must question whether the subspecies aggregations (or lack thereof) are correct. In our view, the analyses do not inspire confidence, and thus we conclude that they do not resolve the question of whether arizonensis is a valid race—based either on the Willcox population or it and some aggregation of other populations.

We have already mentioned that Chesser's (1981) analyses of geographic variation in New Mexico samples of Cynomys ludovicianus deal both with genic and cranial characters. In neither character complex do his analyses multivariately discriminate populations into meaningful geographic units. From this standpoint, no subspecies are recognizable. However, if one examines cranial characters univariately—a step inferred from our discussion of Pizzimenti's (1975) analyses—one does find that discrimination is possible. For example, in width of the third molar, males from the two Tularosa Basin samples (Lincoln and Otero counties) are significantly wider than all samples of this sex, except for two from Roosevelt County. However, this is a minor distinction, and as often as not the two samples from the Tularosa Basin differ inter se—with the former typically averaging larger in measurements.

On the face of the matter, Chesser's (op. cit.) conclusion that the "Tularosa" prairie dog is not subspecifically distinct would appear to have merit. However, Hansen's (1977) claim that the Tularosa Basin prairie dogs average narrower in mastoid breadth and shallower in cranial depth needs evaluation, and we can look at these characters specifically. At the outset, let us point out that Hansen combined sexes in his analyses of these two characters, and he also combined his samples from Lincoln County (10 specimens) and Otero County (2 specimens). Chesser, with more material, kept each of these categories separate, and he found that the Tularosa Basin samples did not differ in any significant, geographically-sensible way from samples from eastern New Mexico. Based on this finding, we would thus accept Chesser's (op. cit.) conclusions over those of Hansen (op. cit.), i.e., Tularosa Basin Cynomys ludovicianus are not sufficiently distinct mensurally to warrant subspecific recognition—at least viz-a-viz eastern New Mexico.

Hansen's (op. cit.) findings on pelage coloration remain the only character by which the "Tularosa" prairie dog might be distinguished from other C. ludovicianus. His sample from the Tularosa Basin is significantly paler in reflectance than all others in his comparisons, including near-topotypical samples of C. l. ludovicianus and C. l. arizonensis, plus one from Hudspeth County, Texas and three from eastern New Mexico. In particular, the Tularosa sample is paler than one from South Dakota-Nebraska, and the latter also differs in being darker than the other southwestern samples. Among the southwestern samples, there are some that also differ inter se, which may mean that variability exists there to a similar degree to that in cranial characters. If this proves to be the case, then the distinction of the Tularosa Basin populations in this character could go the way of those characters already discussed. However, until pelage color is examined more

broadly, we feel that Hansen's (op. cit.) conclusions on the distinctiveness of the Tularosa Basin populations of black-tailed prairie dog in this character cannot be refuted.

To return briefly to the matter of C. l. arizonensis, we do not feel that the matter can be disposed of properly at this time. Until the possible distinctness of the Willcox area population is probed, univariately or otherwise, no aggregation of other samples into so-called arizonensis would seem sound. There is already information (e.g., Pizzimenti 1975) to suggest that even populations from such nearby areas as Chihuahua should not be a priori considered to be examples of that race. If this is the case, then hopes for any definitive resolution of the validity of arizonensis may be difficult--especially considering that the Willcox and most other nearby populations are extinct.

One is tempted to conclude this discussion of subspecies in Cynomys ludovicianus by saying that the species is too variable to warrant further study or concern. This may indeed be the most prudent position to take, as the apparently mosaic variation in populations does seem to defy easy explanation. However, as long as the subspecies concept is to be applied in mammalogy (e.g., Hall 1981), we support efforts to see that this is properly done. In the case of the black-tailed prairie dog, the best course for now may be one in which the species is regarded as monotypic for nomenclatural purposes but as divergent from the standpoint of evolution.

GUNNISON'S PRAIRIE DOG

As in Cynomys ludovicianus, two subspecies have also been named in C. gunnisoni. The nominate form was described from Saguache County, Colorado (Baird 1855:334), while C. g. zuniensis was named from McKinley County, New Mexico (Howell 1916:32-34)--some 225 miles to the southwest. Howell (op. cit.) separated zuniensis from gunnisoni mainly on the basis of the former's paler coloration, and he also attributed to it a slightly larger size--including a larger hind foot and a heavier skull. According to him, the "Zuni" prairie dog was the more widespread of the two races--inhabiting all the range of the species except central-southern Colorado and the adjacent area of northern New Mexico.

Howell's (op. cit.) ranges for these two races of prairie dogs have generally been accepted since his description of zuniensis, and Pizzimenti (1975) used them in his analyses of geographic variation with in C. gunnisoni. The latter study was based on 19 samples, including essentially topotypical ones of the two subspecies. As in his multivariate analyses of C. ludovicianus, Pizzimenti (op. cit.) employed measurements of 15 cranial and three external characters. He did not analyze color, per se.

As we did with C. l. arizonensis, let us begin our discussion of C. g. zuniensis by focusing on the topotypical sample in Pizzimenti's (op. cit.) cluster analyses. In the correlation matrix, this sample stands apart as moderately-well differentiated, being closest to a cluster that includes four samples that are usually considered to be of the nominate form (including the type locality), plus one usually considered to be zuniensis (St. Augustine Plain of New Mexico). However, this particular analysis does not inspire confidence, because it places several samples--representing both races--closer to other species than to C. gunnisoni, including C. leucurus, C. parvidens, and even C. mexicanus!

In the distance matrix, the topotypical zuniensis sample is most closely linked with the St. Augustine sample (= zuniensis), and these two are linked to two samples typically considered to be gunnisoni (Rio Arriba and Colfax counties, New Mexico). Overall, these four samples comprise a group that includes both topotypical and two other presumed gunnisoni samples, plus one other presumed zuniensis (Albuquerque, New Mexico). Overall, this analysis has fewer species-level "glitches" than the correlation matrix, but there are two of note: one C. gunnisoni sample (Springerville, Arizona) is placed closer to C. mexicanus, and two C. leucurus samples are nestled among C. gunnisoni.

Although Pizzimenti (op. cit.:64) concluded that zuniensis is not subspecifically distinct on the basis of measurements, we point out that the same problems exist in his approach here as in the analyses of C. l. arizonensis. By using a fixed set of characters in his analyses—versus only those that actually show some tendencies to distinguish the samples—he may well be obscuring differences and thus failing to recognize patterns of differentiation. These problems could have been avoided by also including univariate analyses; however, Pizzimenti does not do this, and the data to evaluate his recommendation to synonymize zuniensis are lacking.

Although we cannot accept Pizzimenti's (op. cit.) conclusion that zuniensis is not recognizable, this is not to say that it is indeed a valid race. In fact, if it were highly separable, one would hope that this would be apparent from the cluster analyses. Quite likely C. gunnisoni is variable in the same way that C. ludovicianus is, i.e., mosaically to a degree that may preclude recognition of named subspecific categories. Pizzimenti (op. cit:64) does allude to color differences between zuniensis and the nominate form, but it is not clear that he subscribes to these differences. However, pending clarification of this point—or future analyses, if needed—there are grounds for continuing to recognize zuniensis on the basis of its supposed paler coloration.

SUMMARY AND IMPLICATONS

Cynomys ludovicianus and C. gunnisoni are distinct species of prairie dogs in New Mexico, and they remain so inter se throughout the range in which they occur in geographic proximity. Infraspecific variation within C. ludovicianus appears to be largely mosaic in genic characters and in cranial and external measurements. Topotypical (and extinct) C. l. arizonensis may not be separable from nominate C. ludovicianus, but the population of the Tularosa Basin of New Mexico may be distinct in its paler pelage—whether named or not. In C. gunnisoni, the recognition of C. g. zuniensis as a race separable from the nominate form is equally questionable. However, zuniensis may warrant continued recognition—also by virtue of its supposed paler coloration.

This extended discussion of geographic variation in prairie dogs is not meant to be an exercise in esoterica. Instead, we view it as another approach toward understanding the history of these animals in New Mexico, which has an important bearing on the black-footed ferret and its status in the area. In theory, patterns of differentiation in animals such as prairie dogs relate to both selective pressures on populations and to the degree of gene flow among populations. With regard to gene flow, one expects that where it is restricted or broken, the potential for divergence increases. On the other hand, broad levels of gene flow should operate against divergence. While simplistic in some ways, the

relating of levels of gene flow and divergence is an important cornerstone in evolutionary study.

What we see in the patterns of geographic variation within the prairie dog species in New Mexico is a lack of evidence that gene flow has been severely restricted in their recent evolutionary history. In other words, the levels of divergence among populations is either low or apparently random (mosaic). Accepted at face value, this suggests that populations of prairie dogs have experienced relatively broad levels of gene flow for perhaps thousands of years. If this were not the case, then there should be a greater and more aggregated degrees of divergence.

To extend the conclusion of broad levels of gene flow to distribution, we postulate that both the black-tailed and Gunnison's prairie dogs have probably been widely and continuously distributed in New Mexico since at least late Pleistocene times--perhaps to the extent of rivaling the ranges seen in the historic period. This, in turn, means that black-footed ferrets also have had the potential for concomitantly achieving a wide and continuous range in the state, given the probable distribution of their major prey species.

HABITAT ASSOCIATIONS

There are both similarities and differences in habitat use by the two species of prairie dog in New Mexico. The similarities revolve around the fact that both species typically occur in treeless areas that are dominated by grasses and/or forbs. The general impression that we have, both from our own observations and those of others, is that such areas are the preferred habitat of prairie dogs. However, some shrub occurrence may be acceptable to prairie dogs in such habitats as well, while trees seldom are.

The divergence in habitat selection between the two prairie dog species in New Mexico is probably associated with a multitude of factors, including differences in their general biology (including behavior) and the geographic areas that they occupy. While we know of no significant study that quantifies the habitat aspects in which the two species differ, there are many qualitative descriptions of these (e.g., Howell 1916; Bailey 1932; Findley et al. 1975).

In general, the black-tailed prairie dog is truly a prairie species--occupying the eastern plains of the state, up to 5000 or 6000 feet in elevation. In the southern part of New Mexico, this species occupies (or occupied) areas that are generally similar ecologically to prairies--although they may be classed as desert grasslands. Many of these prairie and desert grassland areas have been encroached upon by forbs and shrubs, whether due to the effects of the prairie dogs themselves, livestock grazing, or other factors. In areas where this species of prairie dog has been extirpated, such as the Sub-Mogollon region, it is difficult to state with confidence what the preferred habitat associations may have been. However, we judge the preference to have been for elevated areas of fine-textured soils--versus sandy or rocky areas--typically in grassland zones.

We have rarely seen black-tailed prairie dogs in areas that depart at all markedly in characteristics from those described above. However, several of the earlier records of this species are from places in which such departures appear to have existed. For

example, Bailey (1932) cites perhaps ten localities in foothill or montane areas that hosted the species. Several of these were narrow intrusions of grasslands into wooded areas, including notably in the southwest in the Cliff-Duck Creek-Cactus Flat area of Grant County. Perhaps it is significant that all of these "aberrant" occurrences were in areas where the species has now been extirpated.

In contrast to the above species, Gunnison's prairie dog in New Mexico is much more prone to occur in areas where grassland intrudes into, or is even surrounded by, woodland or forest elements. Classical examples of the latter type are occurrences in the Moreno Valley (Colfax County) in the Sangre de Cristo Mountains and the Valle Grande (Sandoval County) in the Jemez Mountains. These two areas are essentially high altitude (8000 feet or more) grasslands, surrounded by significant areas of forest. It is amazing that prairie dogs were even able to reach such disjunct areas of habitat, and one suspects that this may have occurred along grassland corridors during a drier climatic regime--perhaps thousands of years ago. On the other hand, it is possible that prairie dogs were able to enter such areas along the stream courses that drain them. For example, Bailey (1932:125) mentions that prairie dogs occurred from Black Lake "down the (=to) Guadalupita on Coyote Creek"--which would provide egress to the Moreno Valley, albeit through forested areas.

Other disjunct or near-disjunct areas of occurrences of Gunnison's prairie dogs in New Mexico include parts of Vermejo Ranch (Colfax County), the Chama Valley (Rio Arriba County), and the Taos Plain (Taos County) in the north and Mesa de los Chivatos (McKinley-Cibola counties), and Roberts Park-Centerfire Basin (Catron County) in the west. Such grasslands tend to be of a prairie type, rather than lush, moist mountain meadows; however, some are, at times, rather luxuriant--especially with good moisture.

As interesting as these more montane populations of Gunnison's prairie dogs may be, and they may range to 10,000 feet (Bailey 1932:152), many others occur in more plains-like areas--where their distribution may be extensive and contiguous in nature. Broad alluvial valley between hills and low mountains are favored areas of occupancy by this species in the state. It is in these areas and similar montane sites that this species occurs in the greatest numbers, as one would expect in the space available. Besides such sites, these prairie dogs also occur in floodplains, playas, and vacant land in and near urban areas (e.g., in Taos, Espanola, Santa Fe, and Socorro). Urban Cynomys are not limited to this species, as black-tailed prairie dogs occur in such places as Raton and Lovington in eastern New Mexico.

More so than in black-tailed prairie dogs, Gunnison's prairie dog seems to tolerate shrubs in its environment--including sagebrush (Artemisia spp.), rabbitbrush (Chrysothamnus spp.), and saltbrush (Atriplex spp.). In fact, with their often inconspicuous burrows, colonies of Gunnison's prairie dogs may be difficult to discern in shrubby sites. Tree encroachment is much more prevalent in or near colonies of this species than in black-tailed prairie dogs, although it is not at all commonplace.

CONTROL PROGRAMS AND THEIR IMPACTS

The earliest "control" of prairie dogs by humans in what is now New Mexico was

presumably by prehistoric farmers protecting their crops. We assume the early Europeans also controlled these animals in agricultural areas. However, we suspect that it was the arrival of numbers of settlers from the eastern and central United States ("anglos"), beginning in the middle and later nineteenth century, that gave the major impetus to controlling prairie dogs and other wildlife in the state.

While we do not presume to have all the facts in the matter, it is interesting to speculate about the factors that led to control programs massive enough to so reduce species such as prairie dogs in New Mexico. At the outset, we certainly recognize that prairie dogs and other species cause damage to rangeland, crops, and improvements that people depend on for a living. Prairie dog burrows also represent a danger to humans and other animals traversing colonies of these animals, with broken legs and other injuries or even death awaiting the unwary. In the twentieth century, prairie dogs have also been implicated in spreading sylvatic plague, and when all else fails they are simply labelled as vermin or nuisances.

Our speculation that anglos spearheaded the movement to control prairie dogs, or other wildlife, should not be interpreted as meaning that we believe earlier people of New Mexico were not antagonistic toward the depredations of such species. To the contrary, both the Indians and the Spanish probably did as much as they could to eliminate or reduce such impacts. However, the anglo population probably introduced several elements that made the prospect of massive control more likely to occur. For one thing, we presume that anglos had greater economic means to undertake control through such means as shooting, poisoning, gassing, and other "high tech" approaches. For another, there may have been a greater prevalence of the attitude among anglos that they should and could achieve control—in fact, that it was an obligation rooted in a view that man should dominate the Earth and its creatures. In addition, anglos pushed deeper and in increasing numbers into the hinterlands, and thus they were bound to have greater conflicts with wildlife. Finally, the federal government did its share to encourage and carry out control--as well as other public projects--to encourage settlement of the West and thus to secure the region for the Union.

Whatever the origin, by the late nineteenth it is apparent that the stage was being set for an enormous assault on prairie dogs in New Mexico. For example, Bailey (1932:130-131) quotes a John McDermott from San Juan County, to the effect that " . . . the ravages of prairie dogs . . ." did crop damage in excess of $250.00. The time was 1888, and McDermott mentioned having tried to combat the rodents using strychnine grain, phosporized wheat, and Paris green and bran. Even bisulfide of carbon was available then for control, but at 75 cents per pound it was costly to use.

The complaints of American citizens reached the ears of the political establishment, and the U. S. government entered the battle to control prairie dogs and other species about the beginning of the twentieth century (Merriam 1902). Members of the U. S. Department of Agriculture's Bureau of Biological Survey and other federal agencies early on proved that prairie dogs could be effectively controlled, using demonstration projects in New Mexico and other western states. Largescale control programs were soon initiated by the Survey on federal lands, and cooperative efforts were also begun on private holdings--typically through state extension services.

The beginning of significant control work in New Mexico was about 1914, with large crews from the Biological Survey distributing strychnine grain in areas occupied by prairie dogs and other "noxious" mammals (Shriver 1965). Baseline figures for the extent of New Mexico occupied by prairie dogs prior to 1914 are lacking, but by 1919 it was estimated that significant reductions in these rodents had already occurred. At the latter time, it was estimated that areas still occupied by prairie dogs totalled 3,429,000 acres on federal land and 8,522,000 on private land (Shriver op. cit.). This represented about 15.3% of the state's area occupied by prairie dogs, versus an estimated 0.6% in 1979-81 (Bodenchuck 1982).

Strychnine grain continued to be the primary agent for prairie dog control in New Mexico into the post-World War II period, with carbon bisulfide or other gas-producing agents used for "cleanup" operations then and later (Shriver 1965). In 1947, grain treated with compound 1080 (sodium flouroacetate) was introduced as a control measure (Shriver op. cit.), and it remained in use until being rescinded in 1972--by Presidential Executive Order No. 11643 (Hodges 1972). Since 1972, agents used to control prairie dogs in New Mexico have primarily been strychnine and zinc phosphide grain and phostoxin tablets (Fish and Wildlife Service files). As stated earlier, zinc phosphide grain is the least detrimental to non-target wildlife, while phostoxin gassing is the most detrimental of the above agents.

We have examined the files of the U. S. Fish and Wildlife Service (Animal Damage Control) in Albuquerque, New Mexico in an effort to document the extent of federal control of prairie dogs in New Mexico in the period 1914-1981. Acreages treated to control prairie dogs were not distinguished from acreages for rodents and lagomorphs as a whole in the period 1914-1929, so the information for that period is imprecise. In addition, data were lacking, in total or in part, for several years, i.e., 1921, 1939, 1951, and 1953.

In Figure 8 we have plotted the acreages that were treated to control rodents and lagomorphs in New Mexico in the period 1914-1981. Several notable peaks are evident, including 1919-1922, 1930, 1935-1938, and 1941-1942. We are not certain as to the reason(s) for lower intervening levels of control (e.g., 1924-1927, 1933-1934, and 1939), but these may be related more to funding availability than to reductions in the target species. Following the beginning of World War II, the level of control dropped and remained at a relatively low level through 1951, then it surged in 1952-1953, 1959, and 1963. Again, we are unsure as to the cause of these fluctuations. Since 1964, control levels have been relatively low, but a minor increase began in 1976 and continued to 1980.

The targets of rodent/lagomorph control in the 1914-1981 period were mainly prairie dogs, kangaroo rats (Dipidomys spp.), and pocket gophers (Thomomys spp., Geomys spp., and Pappogeomys spp.). Other targets included jackrabbits (predominantly Lepus californicus), ground squirrels (mainly Spermophilus spp.), cricetid rodents (especially Neotoma spp., Peromyscus spp.), and locally voles (Microtus spp.), murid rodents (Mus musculus and Rattus spp.), and porcupines (Erethizon dorsatum) -- based on data in U.S. Fish and Wildlife Service files and other sources.

In the period 1931-1981, acreages on which prairie dogs were controlled are

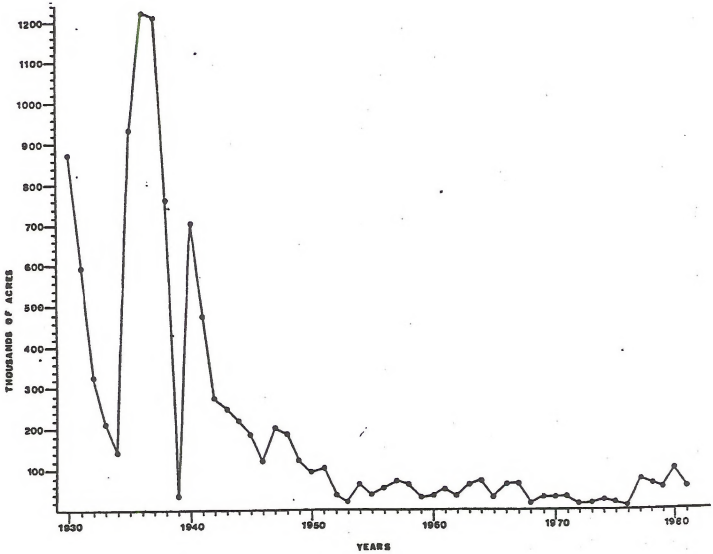


FIGURE 8. Acres treated to control rodents and lagomorphs in New Mexico in the period 1914-1981. (Data from U. S. Fish and Wildlife Service files.)

specifically identified in the above files, and these are plotted in Figure 9. Three high points are identifiable, these being 1930, 1935-1938, and 1940. The highs in the 1930's correspond to the rodent/lagomorph highs already discussed, but the 1940 high for prairie dogs was not one for the overall program. Following 1940, prairie dog control efforts generally declined to the present, contrasted to peaks in overall control for such periods as 1941-42, 1953, 1959, and 1963. What this shows is that the "need" for prairie dog control dropped markedly after 1940-1941, even while control of other types remained reasonably high through 1963.

In order to gauge the extent of control efforts in black-tailed versus Gunnison's prairie dogs, we have plotted the acreages of rodents/lagomorphs controlled in the respective ranges of the two species in the period 1931-1957—as shown in figures 10 and 11. The data show no sigificant differences in the relative extent to which the two species of prairie dogs might have been treated in this period, which generally parallels the major peaks of treatment discussed above. We also plotted ranges, averages, and years of maximum acreages controlled for rodents/lagomorphs from this period to show how counties within the ranges of the two species of prairie dogs compare (figures 12 and 13). It is obvious from these data that some of the counties receiving greater levels of control were not treated for prairie dogs, because these animals were relatively less numerous there —e.g., Dona Ana, Luna, and Otero counties in the range of the black-tailed prairie dog. By the same token, some areas known to support sizeable populations of these rodents were relatively lightly treated, such as Harding and Roosevelt counties in the range of the black-tailed prairie dog.

Although the graphs demonstrate the extents of both rodent/lagomorph and prairie dog control in New Mexico for the period 1914-1981, it is instructive to mention some actual acreages as well. For example, we estimate roughly that some 34,080,000 million acres were treated to control rodents and lagomorphs in New Mexico in the period (1921 data missing), or an area equivalent to 45.1% of the entire state. As for prairie dogs, an estimated 10,800,000 acres were treated from 1931 through 1981, or about 13.9% of the state. In this same period (1931-1981), the area treated for rodents and lagomorphs combined is estimated at 17,870,000 acres, of which 60.4% was for prairie dogs.

Control of prairie dogs continues in New Mexico, generally by the lethal means developed in the past and usually on a rather small scale. Most control is still done for the purpose of protecting rangeland, crops, and farming developments from these animals. However, from time-to-time there are control programs for other purposes, including to suppress populations of prairie dogs for their presumed role in the transmission of sylvatic plague to humans. As an apparent example of the latter, we know of such control being practiced in several northern urban areas in the state in the summer of 1983—in part and perhaps largely as a response to a greater incidence than normal of plague being recorded. The largest control projection may have been in the Taos area, where a reported 41,050 prairie dog burrows were said to have been poisoned (Associated Press 1983). Such control of prairie dogs is of very questionable value, given that these rodents are merely one of a varied host of carriers (see below).

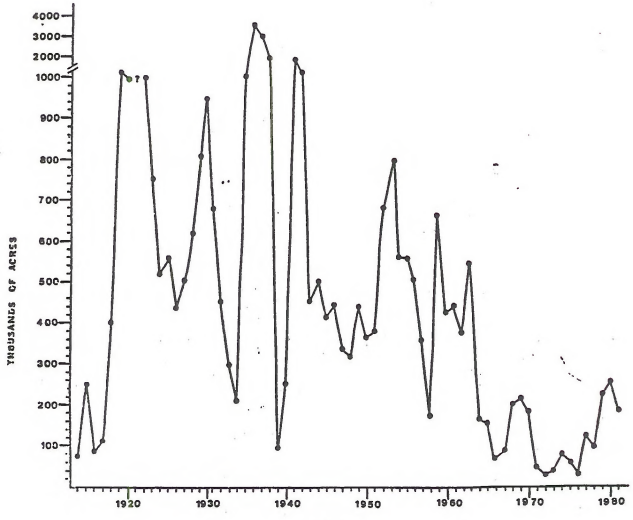


FIGURE 9. Acres treated to control prairie dogs in New Mexico in the period 1931-1981. (Data from U. S. Fish and Wildlife Service files.)

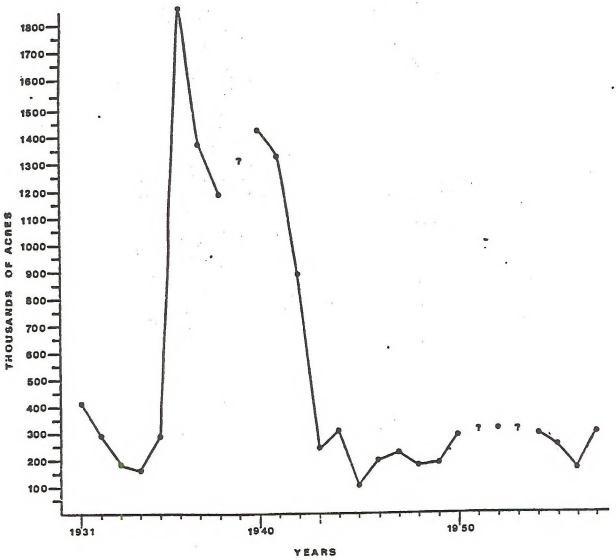


FIGURE 10. Acres treated to control rodents and lagomorphs in New Mexico in the range of the black-tailed prairie dog in the period 1931-1957. (Data from U. S. Fish and Wildlife Service files.)

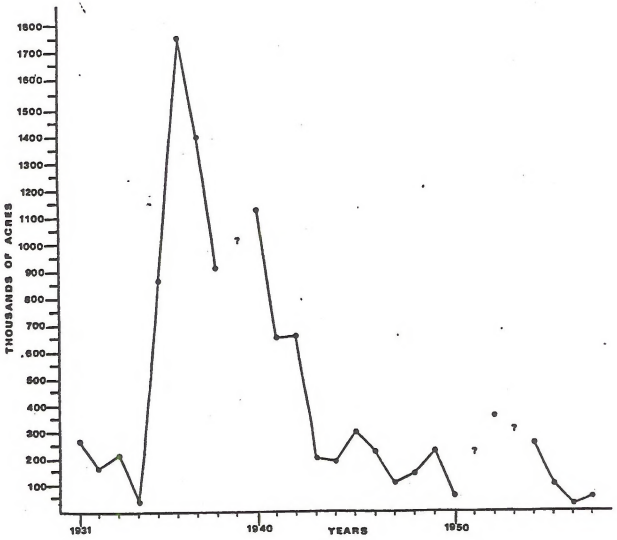


FIGURE 11. Acres treated to control rodents and lagomorphs in New Mexico in the range of Gunnison's prairie dog in the period 1931-1957. (Data from U. S. Fish and Wildlife Service files.)

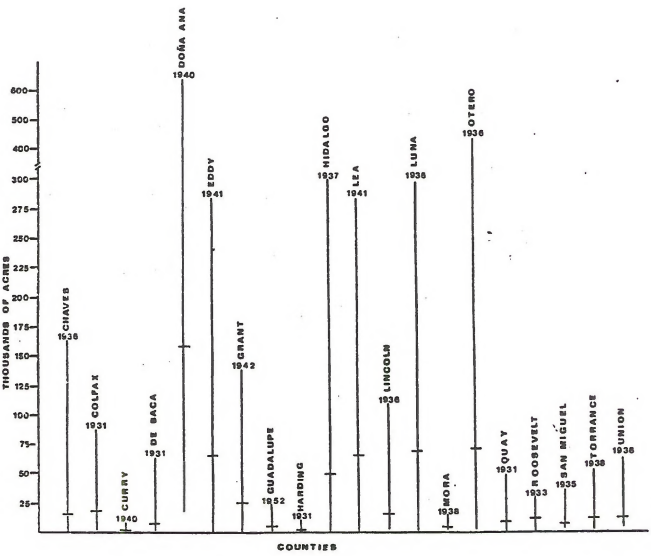


FIGURE 12. Acres treated to control rodents and lagomorphs in New Mexico counties in the range of the black-tailed prairie dog in the period 1931-1957. The vertical line represents the range, the horizontal bar the mean, and the year the maximum in acres treated for each county. (Data from U. S. Fish and Wildlife Service files.)

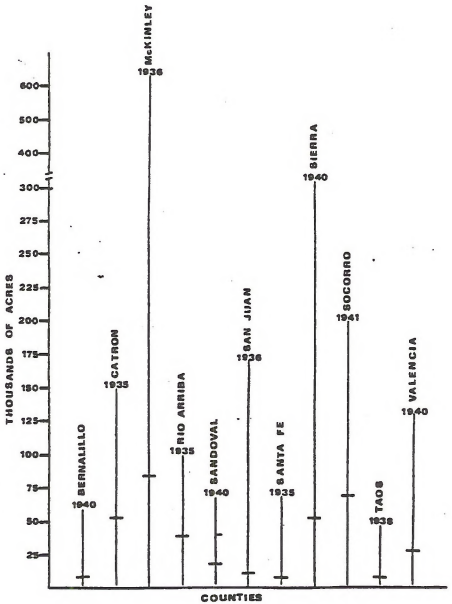


FIGURE 13. Acres treated to control rodents and lagomorphs in New Mexico counties in the range of Gunnison's prairie dog in the period 1931-1957. The vertical line represents the range, the horizontal bar the mean, and the year the maximum in acres treated for each county. (Data from the U. S. Fish and Wildlife Service files.)

SYLVATIC PLAGUE AND ITS IMPACTS

Sylvatic plague is a disease of man and other organisms that is caused by the bacterium Yersinia pestis and is typically transmitted by fleas (Poland and Barnes 1979). The disease is variously called bubonic plague, pest (peste), and Black Death, and it receives much of its notoriety as a pandemic that killed countless people in Europe in the Middle Ages. Plague is a serious disease, and it causes human mortalities when not treated in a timely fashion. However, it can be cured by antibiotics in its early stages, and it should not be a cause for dread or hysteria.

Sylvatic plague presumably originated in the Old World, where it has been known for centuries (Poland and Barnes op. cit.). The timing of its appearance in North America is a matter of some conjecture, but the first human case on the continent was diagnosed in 1925 (Poland and Barnes op. cit.). In New Mexico, the first human case was in 1949 (Rollag et al. 1981). However, both of these dates follow by considerably the detection of the disease in rodents.

The first detection of plague in rodents in North America was in 1908 in the San Francisco area of California, among California ground squirrels, Spermophilus beecheyi (Barnes 1982:238-239). Presumably the source of plague there was shipborne rodents (i.e., Rattus and or Mus) from overseas. Plague spread gradually through native rodents in the western United States, reaching New Mexico by 1938 (Laney 1950). The latter date was probably well after the arrival of plague in that state, because by then it has been confirmed in two widely separated counties, i.e., Catron and Dona Ana (Gabrielson 1939:69). In the period 1970-1980, plague was confirmed in all but two of 32 counties in the state (Barnes op. cit.:248) — the highest such incidence in the United States.

Prairie dogs of New Mexico's species are well-known as hosts of both plague and the fleas that transmit the disease (Barnes 1982). In particular, Gunnison's prairie dog and two of its fleas, Opisocrostis tuberculatus and O. hirsutus, are identified as carriers of plague in the Southwest (Barnes op. cit.:253). Periodic outbreaks of plague devastate populations of this prairie dog in the region, with mortality rates regularly exceeding 99%. Similar outbreaks have been observed elsewhere in black-tailed prairie dogs, which hosts the same flea species. However, it appears that New Mexico populations of black-tailed prairie dogs are less impacted than are those of Gunnison's prairie dog (T. Brown, pers. comm.); in fact, as of this writing we know of no proven instance of plague being confirmed in the former species in the state.

The devastation that plague periodically wreaks on prairie dogs will probably remain on the scene in North America indefinitely. The fact that an afflicted prairie dog population may die out does not end the presence of Yersinia pestis in an area, for this organism persists in many other species as well (Barnes 1982). For example, in New Mexico the list of known, plague-infected mammals includes eighteen species of rodents, two lagomorphs, and nine carnivores (T. Brown, n.d.). Gunnison's prairie dog and five other species of sciurids are among the listed rodents.

The prognosis for at least Gunnison's prairie dog in New Mexico would not appear to be good, as far as plague is concerned. This, in turn, could well affect the prognosis for

black-footed ferrets in the New Mexico range of that prairie dog, assuming that the periodic die-offs of the major prey species would be difficult for the carnivore to tolerate. In fact, a widespread coalescing of plague-induced die-offs in populations of these rodents could foreseeably stress attendant ferret populations quite severely. This is not to say that we expect prairie dogs to be extirpated by plague, for such does not seem to be in the offing. The facts that plague has been in New Mexico for at least 45 years and that we still have prairie dogs attest to the unlikelihood of these rodents being extirpated by the disease.

We do not wish to paint a gloomy picture about the prospects of black-footed ferrets being able to survive in New Mexico in the face of plague impacts on prairie dogs. However, sylvatic plague is here to stay. Therefore, we need to understand much more about it and its ecological impacts, if the prospects of conserving ferrets here are to be really understood. Among questions that need probing is, what likelihood is there that prairie dogs might develop some or greater immunity to plague? Others include, why do there seem to be different susceptibilities to plague in Gunnison's versus black-tailed prairie dogs in New Mexico? And, can eradication of fleas or prophylactic management of the prairie dog's environment decrease the susceptibility of these rodents to plague? Once we are in a position to answer these and other questions, we should be better able to construct reasonable scenarios regarding the potential for conservation of ferrets in New Mexico. In the meanwhile, we must do everything we can to gather, analyze, and understand the data that are already available, for they may hold important clues as to where we are and where we need to go in this aspect of ferret conservation.

THE STATUS OF THE BLACK-FOOTED FERRET IN NEW MEXICO

The black-footed ferret has occurred in New Mexico for many thousands of years, and it persisted here well into twentieth century. The following discussion details as much of the salient information about the species in the state as we have been able to discern. We regard this level of detailing as essential toward our efforts in conserving this species in New Mexico, where we have reason to believe that the animal may still occur. Our sources of data have been many and varied, but chief among them has been the literature (see Bibliography). In addition, we have also sought unpublished information from a variety of sources, including museums, institutions, agencies, and individuals (Table 1). The findings presented here represent a "first cut" of the data, which we recognize are incomplete and subject to modification, expansion, and reinterpretation.

PREHISTORIC DISTRIBUTION

PALEONTOLOGICAL RECORDS

The black-footed ferret is attributed to two paleontological sites in New Mexico, both probably dating back no earlier than late Pleistocene and both with the stratography not well-defined. The two sites have similar-sized mammal faunas, with two-thirds of the species in them persisting in the areas into historic times.

The first of these sites is the Isleta Caves (figure 14), which are located about eight miles west of Isleta in Bernalillo County (Harris and Findley 1964). The black-footed

TABLE 1. Organizations, institutions, individuals, and others who were contacted or visited concerning possible records of black-footed ferrets in New Mexico.

MUSEUMS

Museum of Zoology, Louisiana State University
Museum of Zoology, University of Massachusetts
Museum of Comparative Zoology, Harvard University (Massachusetts)
The Museum, Michigan State University
University of Nebraska State Museum
Cleveland (Ohio) Museum of Natural History
Texas Memorial Museum
Dallas (Texas) Museum of Natural History
Chicago (Illinois) Academy of Sciences
Denver (Colorado) Museum of Natural History
James Ford Bell Museum of Natural History, University of Minnesota
Carnegie Museum of Natural History (Pennsylvania)
Field Museum of Natural History (Illinois)
Stovall Museum of Science and History, University of Oklahoma
Strecker Museum, Baylor University (Texas)
Museum of Vertebrate Zoology, University of California
Museum of Northern Arizona
San Diego (California) Natural History Museum
University of Colorado Museum
Florida State Museum
Idaho Museum of Natural History
Museum of Natural History, University of Illinois
Richard H. Schmidt Museum of Natural History, Emporia (Kansas) State Univ.
Museum of the High Plains, Fort Hays (Kansas) State University
The Museum, Texas Tech University
Utah Museum of Natural History
Milwaukee (Wisconsin) Public Museum
Academy of Natural Sciences, Philadelphia (Pennsylvania)
Natural History Museum of Los Angeles (California) County
American Museum of Natural History (New York)
University of Michigan Museum of Zoology
Museum of Natural History, University of Kansas
California Academy of Sciences
Peabody Museum of Natural History, Yale University (Connecticut)
Museum of Natural History, Eastern New Mexico University
Museum of Southwestern Biology, University of New Mexico
Department of Biology, Western New Mexico University
Department of Biology and Department of Fishery and Wildlife Sciences, New Mexico State University
U. S. National Museum of Natural History
U. S. Fish and Wildlife Service, Denver (Colorado) Research Center
Department of Biology, Virginia Polytechnic Institute and State University

Delaware Museum of Natural History
Moore Collection, Occidental College (California)

FEDERAL AGENCIES

Bureau of Land Management, State Office, Santa Fe, New Mexico
U. S. Fish and Wildlife Service, Regional Office, Albuquerque, New Mexico
U.S.D.A. Forest Service, Regional Office, Albuquerque, New Mexico
National Park Service, Regional Office, Santa Fe, New Mexico
Soil Conservation Service, State Office, Albuquerque, New Mexico

STATE AGENCIES

State Park and Recreation Division, Santa Fe, New Mexico
State Forestry Division, Santa Fe, New Mexico
Soil and Water Conservation Division, Santa Fe, New Mexico
State Department of Agriculture, Las Cruces, New Mexico

INDIAN TRIBES

Mescalero Apache Tribe, Mescalero, New Mexico
Navajo Tribal Council, Window Rock, Arizona
Jicarilla Apache Tribe, Dulce, New Mexico
Pueblo of Zuni, Zuni, New Mexico

INDIVIDUALS

Many of the people who submitted records through 1982 were contacted, including by telephone, mail, or in person. This list is too voluminous to outline here, but the names are in the files of the Department of Game and Fish, Santa Fe, New Mexico. In addition, we solicit records of ferrets and other information from numerous people, including especially from persons who were active in animal control operations and field work in and near New Mexico in the period 1901-1950. Among these individuals were:

Elliott Barker
Arnold Bayne
Carl Berghofer
Warren D. Bloys
Adrey E. Borell
Howard Campbell
Fred W. Carpenter
Lawrence V. Compton
William E. Fair
Frank Fanning
Alton Ford
Victor Garcia
Dorothy Hodges
William S. Huey
Andy Jensen
William J. Koster
Frank Lamb
T. J. Lyon
Larry Merovka
George Merrill
William Mobley
Gale Monson
Homer Pickens
Ronnie Price
Charles A. Walter
Milton Webster

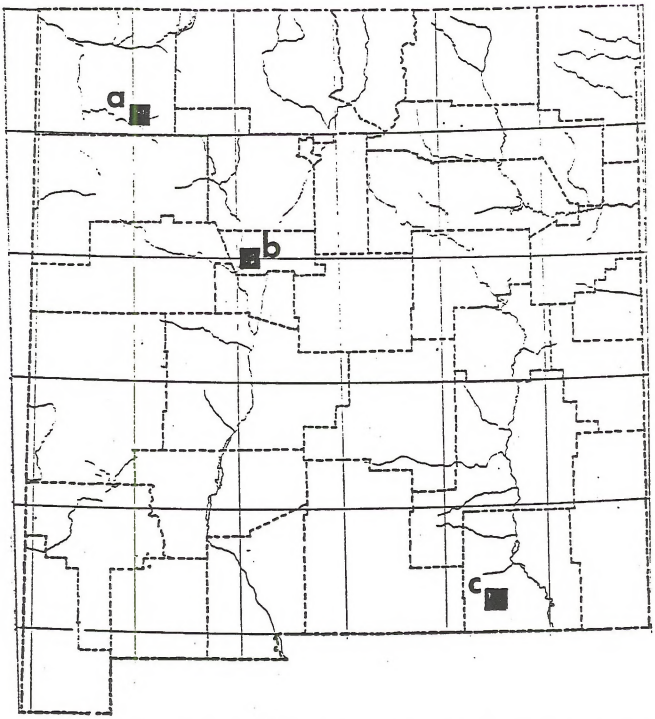


FIGURE 14. Prehistoric records of the black-footed ferret in New Mexico: a. Atlatl Cave; b. Isleta Caves; and c. Burnet Cave. (Respective sources are Gillespie ms.; Harris and Findley 1964; and Schultz and Howard 1935.)

ferret is identified from these deposits on the basis of multiple bones, representing at least three individuals (A. Harris pers. comm.). Among the other species of interest there are several that might have served as prey for ferrets, including the Gunnison's prairie dog and nineteen other kinds of rodents and lagomorphs. This locality is within the historic range of the ferret in New Mexico, a verified record having come from about twenty miles to the north-northeast (Albuquerque).

The second paleontological record attributed to the black-footed ferret in New Mexico is from Burnet Cave (Figure 14), some 50 road-miles west of Carlsbad in the Guadalupe Mountains of Eddy County (Schultz and Howard 1935). The ferret remains consist of a "portion of maxilla with right P3-4," but Anderson (1977) has questioned its identification as Mustela nigripes. It is from a juvenile, and it could just as well be a mink (M. vison) on the basis of size. Among the potential prey species for ferrets in the fauna are the black-tailed prairie dog and sixteen other kinds of rodents and lagomorphs. This site is near the historic range of the ferret in New Mexico, the nearest verified locality being about 80 miles to the north-northwest.

The implications of the paleontological occurrences attributed to the black-footed ferret in New Mexico are speculative at best. However, it is notable that remains of prairie dogs were also found at both sites, along with a host of other potential prey species for the ferret. The presence of at least three ferrets in the Isleta Caves fauna is notable, and it suggests that the species was reasonably numerous in the area. An even more remarkable paleontological occurrence is that of fifteen ferrets at Little Box Elder Cave in Wyoming (Anderson 1968:12).

ARCHEOLOGICAL RECORD

Only one black-footed ferret record is known to us from archeological sources, that being from Atlatl Cave (Figure 14) in San Juan County (Gillespie ms.). The occurrence is based on one left dentary, charred and recovered from a hearth that dates from 2,000 to 3,000 B.P. This record is almost certainly within the historic range of the ferret in the state, being about 50 miles north and northeast of the two nearest verified records.

As with the paleontological records attributed to the black-footed ferret from New Mexico, we can only speculate at the implications of the present archeological record of the species. The animal in question may have been a food item for early humans in the area, as Gillespie (ms) suggests. Perhaps more importantly, this record—coupled with the two already discussed—indicates that the black-footed ferret may have been relatively widespread, if not numerous, in the state, at the close of the Pleistocene and later.

It should also be pointed out that one or both of the paleontological records cited above may, in fact, more properly be considered archaeological in nature, given that artifacts were found in Burnet Cave (Schultz and Howard 1935:293) and the remain of man (Homo sapiens) were found in the Isleta Caves (Harris and Findley 1964:115). Ferret remains at archeological sites could mean that these appearances there were unnatural and therefore perhaps biased toward indicating an excessive frequency of occurrence. However, it seems unlikely that man transported ferrets from such distances as to obscure greatly their actual points of origin in a region.

Related to archeological records of black-footed ferrets are those of ethnographic origin, a subject we insert here for the lack of a better place. We have not researched the matter as regards Indian tribes of the New Mexico area, nor do we have any specific New Mexico records of ferrets from this source. However, Fortenbery (ms.) in 1971 stated: "Ferret pelts have long been used ceremoniously (sic) as medicine pouches by the Navajo and still may be to some extent." Supporting Fortenbery's assertion is the observation by Lawrence V. Compton (pers. comm.) of two or three cased pelts of this species in trading posts on the Navajo Reservation in Arizona in 1935-36. Mr. Compton is of the opinion that these pelts were intended for use as ceremonial objects. Clark (1975) has detailed the use of ferrets in religious rituals by tribes in the northern plains and adjacent regions.

HISTORIC DISTRIBUTION AND STATUS

We will divide this section into two rather arbitrary segments, i.e., 1540 to 1950 and 1951 to 1982. The pre-1951 segment is what might be termed the "golden age" of the black-footed ferret in New Mexico, at least in the sense that we have incontrovertial proof that the species was present in the state. However, the latter part of this period was anything but "golden" for ferrets, as the presumed stresses on the species of a collapsing food base (i.e., prairie dogs) began, accelerated, and climaxed in it--notably 1914 almost through the end of the period. However, it is the body of the verified records of ferrets from this period that gives us our best insights into the distribution, abundance, and most other parameters regarding the species in New Mexico. Therefore, following the enumeration of the records for this period, we will delve in detail into what we perceive as their implications.

With the regard to the 1951-1982 period, we will again enumerate the records and then discuss their implications as perceived by us. However, our slant in discussing these implications will be primarily in treating presumed departures or other changes from the data base derived from the pre-1951 period. As implied above, the 1951-1982 period differs from the latter mainly on the basis of an absence of verified records of ferrets in New Mexico.

SIXTEENTH THROUGH NINETEENTH CENTURIES

We are not aware of any record of the black-footed ferret actually having been reported in this period from New Mexico. However, there is a record that we think dates from the latter part of the period, that being the uncatalogued left dentary of a ferret that is in the U. S. National Museum of Natural History (R. D. Fisher in litt.). Bailey (1932:326) cites what is probably this specimen, stating that "a lower jaw was found in 1903 in a prairie dog town at Santa Rosa." Although Bailey (op. cit.) does not state who purportedly collected this specimen, W. W. Cooke (in Bailey 1928:24, 64) indicates that the former visited Santa Rosa May 19 -June 29, 1903 for the purpose of bird work--as a member of the Bureau of Biological Survey. We know that mammals were also part of such investigations by Biological Survey, so we assume that Bailey or his party collected the purported ferret specimen.

Inasmuch as most, if not all specimen material collected by the Biological Survey went to the U. S. National Museum of Natural History, the 1903 specimen should be

present or recorded there. The fact is, there is no specimen or record with this locality or date at that museum (Fisher op. cit.). However, the left dentary cited above is present, but it was taken at Roswell in 1899. This suggests that Bailey misstated the origin of the specimen that he cited and that Santa Rosa and Roswell records are one and the same, Bailey was at Roswell on June 8-12 and 17-18, 1899 (Bailey 1928:23, 61), and therefore the specimen label (Fisher op. cit.) and his itinerary are in agreement. Therefore, we conclude that the specimen is indeed from Roswell and was taken in 1899.

THE PERIOD 1901-1950

Based on specimens, published and unpublished reports, and oral sources, we have been able to accumulate 32 records of the black-footed ferret in New Mexico in this period. We have divided these records into two categories, one based on extant specimens (Table 2) and the other that lacks such documentation (Table 3). Actually a few of the records in the second category are based on purported scientific specimens, but we have been unable to relocate the material--none of which appears to have been verified by a mammalogist.

Rather than enter into an extended discussion on the individual records in this section, we will do so below--under discreet headings. However, we summarize the records, their ratings, and their percentages of the sample of 32 records as follows (also see Tables 2 and 3):

1. Positive: nine records from seven counties (28.1%).

2. Highly Probable: nine records from eight counties (28.1%).

3. Probable: seven records from four counties (21.9%).

4. Possible: three records from three counties (12.5%).

5. Indeterminate: three records from two counties (9.4%).

6. Questionable: one record in one county (3.1%).

7. Erroneous: no record (0%).

We should also point out that a given record may extend over a several year period, refer to a large area, include multiple sightings, and/or be of more than one animal. Of the 32 records treated here, almost half fall in this broader group. Therefore, the record of ferrets in New Mexico in this period is actually more voluminous than the number 32 above might imply.

Distribution

The records of black-footed ferrets for the period 1901-1950 in New Mexico are from 15 of the state's 33 counties, (asterisk indicates occurrence specimen-verified): *Bernalillo, *Catron, Chaves, *Cibola, *Colfax, Curry, DeBaca, Lea, *Lincoln,

TABLE 2. Extant museum skin specimens for the black-footed ferret from New Mexico. (Asterisk indicates that a skull also exists for that specimen; M=male and F=female.)

Year/ ID No.	Month/ Day	Sex	Location	Collector	Other
1915					
1915-1	Mar 18	M	Catron Co.; Centerfire Basin	J. Stokley Ligon	Yale Peabody Museum (YPM) 1969. "Caught in No. 14 steel trap." (Ligon ms.)
1918					
1918-1	May 1	M	McKinley Co.; 10 mi. n.e. of Mt. Taylor	J. Stokley Ligon	U. S. National Museum (USNM) 228789; "Trapped in blind set for coyote."
1918-2	Oct 15	M	Cibola Co.; 2 mi. n. of Bluewater	C.P. Musgrave	USNM 231363.
1918-3	Nov 22	F	Catron Co.; Garcia Ranch, 75 mi. s.w. of Magdalena	J. S. Felkner	USNM 230773
1925					
1925-1	Nov 14	M	Bernalillo Co.; Albuquerque, 12th Street	J. Stokley Ligon	YPM 1970
1929					
*1929-1	Jul 10 killed Dec 28	F	Colfax Co.; Moreno Valley, 8000 ft. (Agua Fria area)	Shaler E. Aldous	Denver Res. Cnt. D-1210. One of three ferrets seen (Aldous 1940).

1929-2	Apr 7	F	Lincoln Co.; 3 mi. s. of Picacho, 5300 Ft.	Wharton Huber	Acad. Nat. Sci. Philadelphia 14509.
1930					
*1930-1	Aug 31	M	Santa Fe Co.; 8 mi. s.w. of Santa Fe, near Arroyo Hondo	Theodore E. White	Univ. Kansas 7146. Trapped; tracks of another ferret (White ms.).
1934					
*1934-1	Oct 30	?	McKinley Co.; Gallup	M.E. Musgrave	USNM 251453

TABLE 3. Unverified records of black-footed ferrets in New Mexico, 1901-1950. (Asterisk indicates report was from or near prairie dog town; N=number of ferrets; Aut=autumn, Sum=Summer, Var=various.)

Year/ ID No.	Date/ Season	N	Location	Observer	Comments Ratings
1916-17					
1916-1	?	1+	Cibola Co.; Old Fort Wingate	Joseph Crick	Bailey (1932). PROBABLE
1916-2	?	1+	Catron Co.; 4 mi. n. of Luna	Joseph Crick	Bailey (1932). PROBABLE
1916-3	?	4-5+	Catron Co.; Centerfire Creek 10 mi. n.e. of Luna	Joseph Crick	Bailey (1932) Adults and young. PROBABLE
1919					
*1919-1	Sum	4-5	Union Co.; ca. 2 mi. n., 5 mi. w. of Seneca	Fred W. Carpenter	Seen several times in daytime; family group. POSSIBLE
1928					
*1928-1	Sum	1	DeBaca Co.; Ben Hall Ranch, s.e. of Ft. Sumner	Homer Pickens	Captured by "drowning out" and later released. HIGHLY PROBABLE
1930					
*1930-2	Aut?	2	Colfax Co.; Vermejo Ranch, near Castle Rock	Elliott Barker	One trapped and died; another animal seen. HIGHLY PROBABLE

TABLE 3 (Continued)

*1930-3	Aut?	2	Colfax Co.; Vermejo Ranch, Costilla area	Unknown	Fide Elliott Barker. INDETERMINATE
1931-32					
*1931-1	?	2	Catron Co.; 10 mi. s., 1½ mi. w. of Quemado	T.J. Lyon	Animals trapped in prairie dog burrows. HIGHLY PROBABLE
1934					
1934-2	?	1+	San Juan Co.; Sanostee area	Unknown	Kontz (ms.). INDETERMINATE
1934-35					
*1934-3	?	1+	Catron Co.; Snow Lake area	Arnold Bayne	Animals trapped. HIGHLY PROBABLE
1934-37					
*1934-4	Var	6-8	Chaves-Lea cos.; Milnesand-Caprock area	Charles Walter	Seen in daytime. HIGHLY PROBABLE
1935					
*1935-1	Var	1	Curry Co.; n. of Melrose	J.M. Vineyard	POSSIBLE
1937	Sep 25-27	1	Cibola Co.; El Morro National Monument	Jimmie Brewer	McCallum (1979). Animal found dead in pool; study skin prepared but apparently lost. PROBABLE

TABLE 3 (Continued)

1937-38					
1937-2	?	1	County?; between Albuquerque and Gallup	Lawrence V. Compton	Animal seen crossing road at night. PROBABLE
1940					
*1940-1	Aut?	1	Santa Fe Co.; e. side of highway 285, between Lamy and highway 85	Howard Campbell	Seen in daytime. HIGHLY PROBABLE
1940-2	?	1	McKinley Co.; between Window Rock, AZ and Mexican Springs	William E. Fair	Animal dead on road; fluid specimen made but apparently lost. HIGHLY PROBABLE
1941-42					
*1941-1	?	1+	Cibola Co.; Ramah area	Arnold Bayne	Trapped. HIGHLY PROBABLE
1942					
*1942-1	?	1+	McKinley Co.; Gallup area	Arnold Bayne	Trapped. HIGHLY PROBABLE
1944					
1944-1	1+	?	San Juan Co.;Burnham area	Harry Buck	Kontz (ms.). INDETERMINATE
1946-47					
*1946-1	Sum	1	Taos Co.; between Antonito, CO and Questa, e. of Rio Grande	Frank Lamb	Seen in daytime. PROBABLE
1946-51					
1946-2	?	1+	Catron Co.; Jewett Gap area	Ernest Carrejo	Fortenbery (ms.). POSSIBLE

TABLE 3 (End)

1947					
*1947-1	?	1	Roosevelt Co.; 2 mi. n., 1 mi. e. of Dora	Jim Richards, Dora Richards	Seen in daytime. QUESTIONABLE
1950					
*1950-1	?	1	McKinley Co.	Louis Laney	Calahane (1954). PROBABLE

*McKinley, Roosevelt, *Santa Fe, San Juan, Taos, and Union. We have plotted these records in Figure 15, along with line-plots that connect the perimeters of records in various rating categories. The line-plots for positive records shows the most reliably-based distribution of the black-footed ferret in New Mexico, while the addition of line-plots for highly probable, probable, and possible categories add significant increments to the eastern and northern range of the ferret in the state.

Based on the above data, several statements can be made about the distribution of the black-footed ferret in New Mexico in the period 1901-1950. The most conservative one, based on extant specimens, is that the range of this species extended from southern Catron and Lincoln counties northward to southern McKinley, Bernalillo, and western Colfax counties. However, we think that highly probable and probable records are not only reliable, but that they offer a more accurate view of the range. Based on these additions, the range of the ferret in the state extended northward to northern McKinley and northern Taos counties and eastward to easternmost Chaves and southeastern DeBaca counties. Furthermore, we think that quite likely the species also occurred eastward to Union and Curry counties--where there are possible records. In composite view, we believe that the ferret was a widespread species in New Mexico in the period 1901-1950, as shown by at least the positive, highly probable, and probable records (Figure 15).

Abundance

Bailey (1932:326) was the first authoritative source to comment on the abundance of the black-footed ferret in New Mexico in the period 1901-1950, and he regarded the species as "scarce" in the state. In large part, his assessment must have been based on the few records that he had of ferrets, these totaling eight in the manner that we count them. We suspect that his judgement was also colored by his own personal failure to encounter the species alive in the state, in spite of many weeks spent in the field working on mammals here. Other than the partial jawbone found "in 1903 . . . at Santa Rosa." (= in 1899 at Roswell), he must have had no firsthand encounters with the species in the state.

Other than Bailey, perhaps the next most authoritative figure on the status of the black-footed ferret in New Mexico was J. S. Ligon. In fact, Ligon--in his roles as predator-trapper, collector, and naturalist in the state--could be regarded as the authority on the species. He obviously supplied data on the species to Bailey, and he took three of the extant New Mexico specimens. Yet Ligon (1927) fails even to mention the black-footed ferret in his treatise on the state's wildlife, and we have found no information on what his views might have been about the species' abundance or other matters. This lack of information on Ligon's views represents a significant gap in our understanding of the ferret and its status during that important period in the state's history. We believe that Ligon was in a unique position to have gained insights about the species in the state, for reasons that we will discuss in detail later in this report.

In a way, this accumulation of records of ferrets for the period does not really challenge Bailey's (1932:326) views that the species was scarce in New Mexico. For example, if one accepts all 32 records at face value, they average out to about one per year-and-a-half for the years 1901-1950. Even if one looks at the number of ferrets instead of number of records, the overall count of 49-53+ animals is still under one per

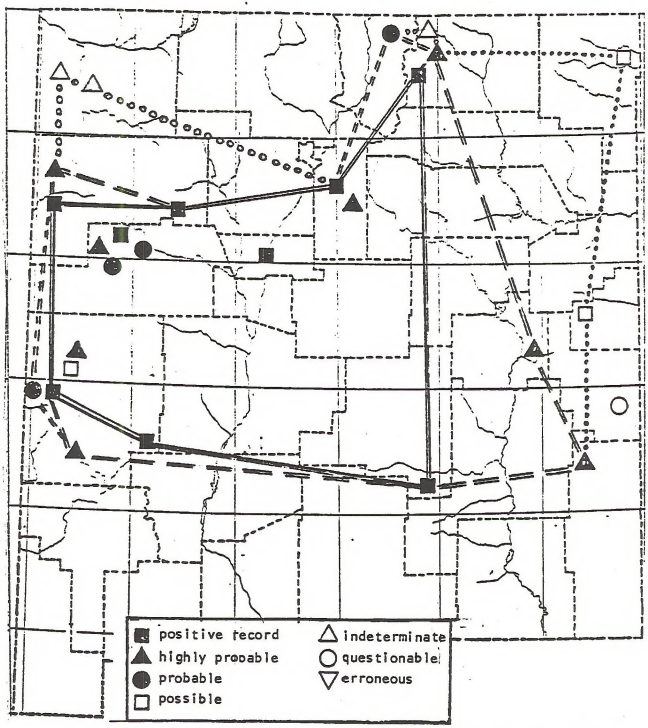


FIGURE 15. Records of the black-footed ferret in New Mexico in the period 1901-1950. Lines connect records that are rated the same, and dark symbols represent the most reliable records.

year. However, we have reason to believe that neither the numbers of records nor those of ferrets is a reliable basis for evaluating the abundance of this species in the state in the period. In fact, considering the problems of detecting ferrets, we feel that 32 records of 49-53+ ferrets is relatively a good data base. Indeed, instead of signifying scarcity, we suspect that this extent of data means that the black-footed ferret was reasonably numerous in the state. The rationale for this assessment is discussed below (see section on "Detection of Ferrets: Implications of the Reliable Records through 1950").

Habitat Associations

Contrary to what may be the popular belief that the black-footed ferret is rather strictly an animal of the Great Plains region, the 1901-1950 records of the species in New Mexico come predominantly from the grassland or grassland-shrubland basins west of the state's eastern prairies. Of the 32 records (Tables 2 and 3) from the period, only five fit the classical "prairie-occupant" concept—these being from Union, DeBaca, Curry, Roosevelt, Chaves, and Lea counties. This is not to say that ferrets did not regularly occupy the prairies of eastern New Mexico, for we are certain that they did. On the other hand, the species was at least equally at home in the basin-and-range sections of the state—ranging to elevations of 8000 feet and probably higher.

It is the higher elevational occurrences of ferrets in New Mexico that may be the best indication of the degree of adaptability in the species—at least in terms of habitat utilization. For example, it was Aldous' (1940) finding of a family of ferrets in the Moreno Valley of Colfax County that provides the record of the species at 8000 feet. The Moreno Valley is an area of grassland in the Sangre de Cristo Mountains, and as indicated elsewhere, it is entirely and effectively cut off from other grasslands by extensive forests. While it is remarkable enough that the black-footed ferret reached that area, perhaps more so is the fact that the Gunnison's prairie dog did—presumably bringing the ferret with it! Incidentally, Hooper (1941:21) incorrectly attributed this notable ferret record to Valencia (= Cibola) County, an error also repeated in Findley et al. (1975).

Other New Mexico records of black-footed ferrets (and prairie dogs) in completely or largely disjunct areas of grassland in the 1901-1950 period include the following (year in parenthesis):

Colfax County - Castle Rock, Vermejo Ranch (1930)
McKinley County - 10 mi. n.e. of Mt. Taylor, presumably on Mesa del Chivato (1918)
Catron County - Centerfire Basin area (1915 and 1916-17) and Snow Lake (1934-1935).

Many of the other westerly records of ferrets in the state are also from areas in which grasslands are rather interrrupted, or at least mosaically distributed, as the result of woodland/forest distribution. In fact, grassland areas of that type are the rule rather than the exception in many areas of northern and western New Mexico, and this was probably true even before the shrub encroachment associated with European settlement.

As discussed earlier in this report, an important—if not essential—element in the "habitat association" of ferrets is that of prairie dogs. While our information for New Mexico ferret records for the period 1901-1950 is far from complete, in no instance was any of the occurrences clearly stated to have been in the absence of prairie dogs. By actual count, 15 of the 32 records (Tables 2 and 3) are known to have been in association with prairie dogs, and we suspect that most of the others were as well.

We do not mean to imply that all of the above records of ferrets were necessarily associated with prairie dog towns, for we can conceive of instances in which they might not have been. We have already discussed situations in which prairie dogs might not be readily available to ferrets, e.g., during periods of the former's winter inactivity. From an energetic standpoint, ferrets in such cases might well seek other prey—at least under some circumstances. In addition, the dispersal of young ferrets away from maternal territories could, at least temporarily, lead to occurrences of individuals outside of prairie dog towns—especially where the rodents were scattered or disjunct in distribution. While we have no proven example of ferrets away from prairie dog areas in the period, we should point out that one record is suggestive of this. That is the one from El Morro National Monument (Cibola County), where a ferret was reported in a pool in September 1937 (McCallum 1979). That occurrence was technically not in a prairie dog town, although colonies of these rodents were probably close by.

Other Findings

Details for most of the New Mexico records of black-footed ferrets in the period 1901-1950 are meager, but present the information that we have been able to glean as follows.

Seasonal distribution of records. Ten of the 32 ferret records are specific as to month, these being the nine specimens (Table 2) and the report from El Morro National Monument (McCallum op. cit.). These records may be summarized as follows:

Month	No. of records	No. ferrets (+ sexes)	County of record
January	0		
February	0		
March	1	1 (male)	Catron
April	1	1 (female)	Lincoln
May	1	1 (male)	McKinley
June	0		
July	1	3 (female and two unknown)	Colfax
August	1	2 (male and unknown)	Santa Fe
September	1	1 (unknown)	Cibola
October	2	2 (male and unknown)	Cibola and McKinley
November	2	2 (male and female)	Bernaillo and Catron

December	0	
Totals	10	13 (5 male, 3 female, 5 unknown)

These data indicate that most ferrets were recorded during the period of greatest human activity outdoors, i.e., the warmer months (March-November). However, the slight prevalence of records in the August-November period may indicate that ferrets were more numerous or otherwise available at that time of year, e.g., through dispersal of young. Six other records were variously given by the observers as summer, autumn, or "the warm months," but exact dates were not specified (Table 3).

Time of day of records. Only seven of the New Mexico ferret records in the period 1901-1950 have details as to the time of day, but these involve 17-20+ ferrets (Tables 2 and 3). All of the ferrets were observed during the daytime, except for one—an animal seen at night between Albuquerque and Grants in 1937-38. Some of these records may not have been under natural circumstances, including that of an adult with two young seen following a gassing operation in a prairie dog town in Moreno Valley, Colfax County (Aldous 1940). However, the data do show that ferrets could be seen during daylight, although we cannot establish that this was frequent.

Information on reproduction. There are only three records in the period for ferret litters having been seen, or with other evidence of reproduction. Only the record from the Moreno Valley specifies a date—i.e., July 10, 1929 for two young only weeks old at the time (Aldous 1960). The other records of litters involve "4 or 5, including young" in Catron County in 1916-1917 (Bailey 1932:326), and a pair with three young in Union County, about the summer of 1919 (F. W. Carpenter pers. comm.).

Sex ratio in specimens. Of the eight sexed specimens from New Mexico, all taken between 1915 and 1934 (Table 2), five (62.5%) are males. The predominance of males may indicate that this sex is more subject to capture than are females, but this is quite speculative. In terms of season of activity by males versus females, we see no trends in the available data (see "Seasonality," above); however, the information is limited.

Information on age structure. All of the nine specimens taken in New Mexico in the years 1915-1934 (Table 2) appear to be fullgrown. However, the Colfax County specimen was captured as a juvenile on July 10, 1929, before being sacrificed on December 29, 1929 (Aldous 1940). We have not examined any of the New Mexico ferrets closely to attempt to age them, but this needs to be done.

In terms of field data on age structure, there are only two additional observations to the above for the period. Carpenter (pers. comm.) reported seeing two adults and three young in Union County about 1919, while in 1916-1917 Joseph Crick recorded an unspecified number of young among four-five ferrets seen in Catron County (Bailey 1932:326).

Measurements of specimens. Measurements are available to us on only four of the

nine New Mexico specimens, but others may be obtainable. These available measurements are as follows (inches converted to mm):

County	Total length	Tail	Hindfoot	Ear
Males (N=3)				
Catron	510.0	123.7	60.6	--
Bernalillo	516.4	117.9	58.7	--
Santa Fe	490.0	114.0	63.0	33.0
Females (N=1)				
*Colfax	401.0	91.0	51.0	14.0

*Estimated to be six months old; raised in captivity (Aldous 1940).

Food habits. The only available information for New Mexico ferrets in the period is from Aldous (1940), who reported on the diet of a young female ferret raised in captivity. He fed the animal on condensed milk for the first few days after its capture, at which time her age was perhaps one-two weeks. She soon accepted the flesh of Gunnison's prairie dog, golden-mantled squirrel (Callospermophilus lateralis), meadowlark (Sturnella sp.), and a "minnow" (Cyprinidae?). The ferret relished this and other fish, and she was fed them and rodents for the first two weeks in captivity. Afterwards she was offered and readily ate a wide array of foods, including "fish, birds, rodents, . . . and cottontail rabbits, calf liver, hamburger, fat pork (both raw and cooked), milk, and bread" (Aldous op. cit.:24). Rejected food material was pushed into the corner.

While these observations apply to a captive animal, they are interesting in that they suggest that ferrets may be rather catholic in their tastes for prey.

Sanitation. The only information comes from the captive female ferret described above (see Food Habits) and raised by Aldous (1940). He reported that the animal always appeared clean, but he never observed her washing herself. He noted that " . . . fecal and urinal deposits were always made in one corner of the dark compartment of the cage, and sand was usually thrown on the accumulated waste." (Aldous op. cit.:24).

Vocalizations. Aldous (1940:23) reported that an adult ferret in Colfax County, when deprived by him of one of its young, uttered a "chattering scold" inside a prairie dog burrow. Later the same vocalization was heard in by Aldous from the captive ferret, in a situation in which it became agitated. Proguiske (1969:62) reported a staccato chattering in a captive ferret in South Dakota, this vocalization consisting of "six or seven clear, loud chirps." This chattering was though to express excitement, and it was uttered almost constantly when people were near it. This ferret was also said to emit commonly "low hissing sounds."

Demeanor. Aldous (1940) indicated that the young female held captive by him was

initially cautious and shy in the presence of strange objects. Gradually she became bolder, and she exhibited curiosity and interest in her environment. Her actions were notably agile and graceful, after an initial awkward stage as a kit. While young, she was playful and responded to being rubbed on her nose and belly by Aldous, and she exhibited a mischievous streak. As she was given a freer run, she became wilder, and on being recaptured after an escape she became vicious.

A ferret taken in a trap near Santa Fe, New Mexico in 1930 was described as having ". . . fought very viciously as is characteristic of the minks" (T. E. White ms.). Progulske (1969) also described a captive ferret in South Dakota as "vicious," as well as "prone to attack" humans that moved near its cage. That animal was estimated to have been something less than three months old when captured. Terms such as "vicious" are, of course, relative and we do not wish to convey the idea that the black-footed ferret is a raging beast—even allowing from anthropomorphism. After all, the above observations were of animals in artificial situations, i.e., in captivity or trapped. Aldous' (1940:23) description of the aggressive behavior of a wild ferret defending its young was also under duress—albeit "vicious." Our point is to emphasize that this species is not an outdoor version of the European ferret, which is generally tame even when seen in the wild. This is not to say that the black-footed ferret would never appear "tame" in the wild, for under some circumstances it might. For example, a sick or injured animal might seem this way. Furthermore, Progulke (1969:620) suggests that the species may have poor distance vision, based on the behavior of a captive animal. If this is true of these ferrets in general, the appearance of tameness in an individual might indicate that it had not discerned the observer.

Sources of mortality. Of the 32 records of ferrets from New Mexico in 1901-1950, twelve involve animals that died under known circumstances. One each of these was killed by an automobile, apparently drowned, and sacrificed in captivity after having been captured by hand. Four other animals are known to have been trapped, and we suspect that all or most of the remaining five animals also met death as the result of having been trapped. Trapping is also produced four other records that either resulted in the release of the animals or some disposition other than as museum specimens (Tables 2 and 3). One other animal was captured after being "drowned out" of a prairie dog burrow with water.

Except for the instance of apparent drowning, the above instances hardly constitute natural causes of mortality. Hillman and Clark (1980) recount instances of this latter sort, and no doubt many of these apply in New Mexico as well--including predation, disease, loss of habitat, and starvation. However, we know of no such recorded instance in New Mexico in the period 1901-1950.

Detection of Ferrets: Implications of the Reliable Records through 1950

Various authorities have pointed out the difficulties in detecting and studying black-footed ferrets, and we agree that a large part of the problem may stem from the habits of the animal, i.e., the tendencies to stay below ground and/or to be active at night. On the other hand, we do not agree that the supposed rarity of ferrets per se is necessarily part of the problem—or at least that it was prior to ferrets being negatively impacted by the activities of twentieth-century man. While we are not saying that ferrets were ever

necessarily abundant, we believe that at one time the species may have been relatively common. We have already discussed some of the reasons for this rationale, and now we wish to treat the subject as regards New Mexico—based on the data on ferrets and related matters through 1950.

To begin, let us point out that the year 1889 was a significant one in New Mexico, because it marked the beginning of an era of intensive survey of the state's mammals—one that would lead to the publication by the Bureau of Biological Survey of the definitive Mammals of New Mexico by Vernon Bailey (1932). The years 1889-1908 were especially productive toward this goal, although additional work was done in following years as well. In spite of the efforts of Biological Survey personnel, plus those of other workers such as Whipple (1856) and Mearns (1907), only one New Mexico record of the black-footed ferret emerges in the historic period prior to 1915—that the 1899 dentary specimen from Roswell.

Does this lack of records mean that ferrets were rare in New Mexico prior to 1915? We think not. Instead, we are of the opinion that ferrets were relatively numerous, but they had been little subjected to activities that would reveal them. Furthermore, we believe that the activities that did reveal them were neither designed to detect ferrets, nor were they really ever exploited to elucidate their status—even, after they were proven in the detection of the animals. We believe that these activities were, in fact, predator-trapping and prairie dog control. Both appear to have produced most of the records of black-footed ferrets in New Mexico in the period 1901-1950. Of the other records, most were the result of activities that mimicked one or both of these two activities in important ways.

At the outset, let us emphasize the point that professional or student mammalogists per se were involved in the taking of only two of the "whole animal" specimens of the black-footed ferret in New Mexico—in spite of their aforementioned efforts expended to collect mammals in the state (e.g., Bailey 1932). Bailey's failure in this regard is particularly notable, because he and his associates certainly had the desire to find ferrets and no doubt expended the effort to do so. As far as the two exceptional mammalogists, (i.e., who took ferrets), these were W. Huber in 1929 and T. E. White in 1930 (Tables 2 and 3). Even so, at least White (ms.) trapped his ferret—as indicated earlier--and Huber may also have done so.

On the other hand, seven of the nine ferret specimens were taken by people that we know or suspect to have been involved at the time in predator control. Most notable are the four specimens taken in the years 1915-1918, i.e., by J. S. Ligon (two), C. P. Musgrave, and J. S. Felkner. According to Bailey (1932) and other sources, these years were among several in a period in which considerable effort was expended by the Biological Survey and others to trap (or poison) gray wolves (Canis lupus), coyotes (C. latrans), and other larger predators in New Mexico. Ligon was involved in this work, and in effect he was in charge of it in the state for several years (e.g., Ligon 1917, 1918, 1919). Both Ligon's 1915 and 1918 ferret specimens are known to have been trapped--cf. Ligon (ms.) for the former and according to the label for the latter.

In fact, Ligon (1918:13) actually refers to the black-footed ferret in one of his

annual reports on predator control. The implication is that trappers took two of the animals in 1918. It is unclear whether "1918" refers to fiscal year or calendar year, but likely it was the former. The fiscal year for 1918 was July 1, 1917 through June 30, 1918, and the annual report for that period covered the Arizona and New Mexico District (Ligon 1918). We know of only one ferret record from the period and area, that being Ligon's May 1, 1918 specimen from McKinley County, New Mexico (Table 2). It is possible that the other record was not of a specimen, or perhaps it was of a specimen that was not saved.

Although Ligon's (1918:13) reference in 1918 is the only specific mention that we can find of the black-footed ferret in the earlier annual reports on predator control in New Mexico, we suspect that this absence is the result of the emphasis given in those documents. Even the 1918 ferret report is not emphasized, appearing in a footnote beginning, "The above tables do not include the following" (Ligon 1918:13). On the other hand, it is quite clear that several of the extant New Mexico ferret specimens were taken by persons known to have been involved in predator control at or near the time the collections were made. Besides Ligon in 1918 (and apparently 1915), these were J. S. Felker in 1918 (Ligon 1919) and M. E. Musgrave in the 1930's (Gatlin 1930). For whatever reason, the ferrets presumably captured under such auspices were simply never acknowledged, and now we must attribute them circumstantially.

We also suspect that C. P. Musgrave was involved in predator control when he took a ferret in Cibola County, New Mexico in 1918. However, we find no reference to him in Ligon's (1917, 1918, 1919) reports for that period, although M. E. Musgrave is mentioned. In fact, Bailey (1932:326) attributes the above specimen to the latter individual, and we wonder if the two might be connected (or the same person?). Whatever the case, this capture was in an area of active predator control, and circumstantially we attribute it to that activity.

Besides Ligon, the Musgraves, and Felkner, we suspect that Joseph Crick's records of "ferrets frequently seen" (Bailey 1932:326) were also obtained in conjunction with predator control. In fact, we would not be surprised if these records of ferrets "seen" actually refer to ones that Crick trapped, but which never made their way into Bailey's hands. Interestingly, all of Crick's 1916-1917 localities for ferrets (Table 3) were at or near areas of concurrent predator control--including the Luna-Centerfire Basin area (Catron County), where Ligon took his first ferret in 1915.

If we are correct in our assessment of the activities of Ligon et al., then all seven of the New Mexico black-footed ferret records for the period 1915-1918 (Tables 2 and 3) were from predator trappers. Of the remaining 25 records, at least 12 were probably associated with either such people or with others involved in controlling prairie dogs. Among the trappers who reported taking ferrets in this period were Bayne in the 1930's and 1940's, Barker in 1930, Lyon in 1936-1937, and apparently M. E. Musgrave in 1934 (Tables 2 and 3).

Among the ferret records that were associated with persons involved in prairie dog control (professional and otherwise) are those of Pickens in 1928, Walters in 1935-37, Campbell in 1940, and Lamb in 1946-1947 (Table 3). Interestingly, however, based on the testimony of such people as these and others, even an extended presence in prairie dog

towns was no guarantee of seeing a ferret. In fact, none of these observers except Walters ever observed more than one ferret, even in years of work controlling prairie dogs. This fact may attest to the rarity of ferrets, but more likely it is further indication of how rarely these animals are active above ground by day. The latter may be especially the case during the warmer months, which is mainly when these people were in the field. On the other hand, the fact that any ferrets at all were seen by them simply emphasizes the point that we have already made—finding ferrets requires spending considerable time in prairie dog towns (plus being observant and lucky as well).

While predator trappers would appear to have been the dominant source of ferret records in New Mexico in the years 1901-1950, we do not wish to imply that there encounters were necessarily commonplace. Yet, if we are correct in believing that ferrets were relatively numerous (at least early in the period), then one would expect more numerous encounters that those here enumerated. Actually, we think that encounters of ferrets by trappers may have been more frequent than the data would indicate. For example, we do not believe that predator trappers operating prior to 1915 could have failed to take ferrets, yet there is no record of this. In this case, we suspect that the animals were taken but not reported, perhaps because the trappers were unaware of any interest in these captures. In this regard, the spate of 1915-1918 records may have been the result of a request for such data from trappers by someone in the Bureau of Biological Survey, e.g., Vernon Bailey himself. However, if this is the case, then interest appears to have waned soon after. For example, Ligon apparently did not report his 1925 specimen (Table 2) to Bailey, and—as we previously mentioned—Ligon (1927) did not even mention that species in his extensive report on the wildlife of New Mexico. Did Ligon merely overlook the ferret in his report, or did he not regard the species as being particularly notable or worthy of comment? These questions we obviously cannot now answer, but perhaps some day we can.

Another factor that may have been operating to reduce ferret records from trappers could relate to the trapping process itself. Various of the oldtime trappers that we have interviewed indicated that their traps were generally not set in prairie dog towns per se, because these rodents would be more apt to get caught than wolves or coyotes. Instead, the traps would be set nearby, so that foraging predators entering a prairie dog town would encounter them more readily than would the rodents. Thus, if ferrets were caught under these circumstances, it was because these animals wandered to the edge and beyond the prairie dog towns.

We suspect that in some instances traps for predators were set in active prairie dog towns, in spite of the likelihood that these rodents rather than predators would be caught. In fact, it seems possible that at times the object might have been to capture prairie dogs, which could then be dispatched and used to attract predators—either as bait in traps or near blind sets. Trapping of prairie dogs would probably have been simpler than shooting them, as it would largely have eliminated retrieval problems.

Needless to say, any trapping of prairie dogs for predator bait could well have resulted in the taking of black-footed ferrets. Even so, the greater abundance of prairie dogs over ferrets would have most likely yielded many more of the rodents than ferrets. The locating of predator traps at the peripheries or further from prairie dog towns would

also have reduced the ferret catch. Thus, in either case, the trapping record for ferrets would likely be biased toward fewer of the animals being trapped than might exist in an area.

In regard to trapping ferrets in or near prairie dog towns, it would seem that modifications could have been made that would have increased the take of this species--if one had desired this result. For example, it would have been desirable to place traps in prairie dog towns rather than at their peripheries or beyond. In addition, the traps should have been set after the prairie dogs retired for the night, and the traps should have been taken up in the morning before the rodents ventured from their burrows. It might also have helped to reduce the numbers of prairie dogs in a town, in order to induce any ferrets to have moved above ground in search of occupied burrows. In this case, traps might have been left out by day to help in reducing prairie dog numbers. If this scenario sounds far-fetched, recall the 26 ferrets that were taken in two counties of Kansas in an eleven-year period (Choate et al. 1982). While we do not know that the collectors were specifically after ferrets, it is difficult to believe that such a concentrated take was merely coincidental.

We believe that the scenarios developed above are worthwhile, because they represent an effort to understand the circumstances associated with ferret occurrences in New Mexico and to apply any such understanding toward conserving the species here. In particular, we find the traditional view that ferrets have always been rare in New Mexico --at least in historic times--to be questionable at best, if not actually counter-productive. We hope that we have made a case for our views that the ferret was elusive rather than having been rare in the state. If we succeed in this endeavor, perhaps it will help increase interest and efforts toward locating ferrets in New Mexico and hopefully conserving them here.

THE PERIOD 1951-1982

Following the "golden age" (1901-1950) of the black-footed ferret in New Mexico has been a period of over three decades in which the species has not been verified in the state. In fact, given that the last extant specimen was taken in 1934 (Table 2), 1983 marks the 50th year since the black-footed ferret has been verified in New Mexico. However, the picture is not as bleak as it would appear, as there have been scores of reports in the present period--some of which appear to be reliable records that indicate that the black-footed ferret may have persisted in the state.

In discussing the records for the 1951-1982 period, we have divided them into three chronological segments: 1951-1963, 1964-1977, and 1978-1982. The period 1951-1963 might be termed the era of "darkness before dawn" for the black-footed ferret, a period in which grave doubts existed that the species might still survive anywhere. The next period (1964-1977) sparked by both the listing of the ferret as an endangered species (U. S. Department of the Interior 1964) and the discovery of a population of ferrets in South Dakota (Henderson et al. 1969), represented a revival in the interest in the species. Finally, 1978-1982 marks an era of heightened concern and renewed optimism for the future of the ferret--keynoted by the discovery of a significant population in the Bighorn

Basin of Wyoming (Kearney 1983). In New Mexico, the period 1978-1982 was marked by commitment by several agencies and individuals toward locating and conserving the species in the state. While the latter efforts have not yet produced ferret populations to conserve in New Mexico, we are hopeful that they will. At the very least, the renewed awareness of ferrets may benefit other species and thereby improve efforts to conserve the state's biota as a whole.

In rating New Mexico ferret records for the period 1951-1982, we have attempted to retain comparability in our approach to that used for the 1901-1950 period. However, we recognize that basic differences exist between the two groups of records, as observers in the later period are more often available to be interviewed and they more often recall critical details of the records. This availability and better recall are more the mark of records of the 1970's and later, but these factors also extend to some earlier reports as well. The fact that we can usually better probe more recent records of ferrets means that these may tend to be more closely scrutinized. In the process, we suspect that more recent records tend to be rated somewhat more rigorously than older ones, although we tried to treat them similarly. However, even if more recent records have been treated more conservatively as a group, we still feel that the better records will rate high, regardless--therefore, drawing our attention to the most likely areas to harbor black-footed ferrets in the state. We feel this approach is preferable to a rating system that might fail to enhance such records and thereby obscure likely reports among unlikely ones. After all, resources for ferret searches are finite, and we need to be as selective as possible by focusing mainly on the better prospects.

The Period 1951-1963

For this 13-year period we have been able to discover only seven records (Table 4), one of which we rate as indeterminate, two as possible, and the others as probable. Most of the records are in or near the likely historic range of the black-footed ferret in New Mexico; however, the report from Hidalgo County is a notable exception. This record was obtained from Arnold Bayne (pers. comm.), a retired government trapper who reported taking ferrets in the Gallup, Ramah, and Snow Lake areas in the 1930's and 1940's (Table 3). In view of Bayne's previous ferret experience, we find it difficult to rate the Hidalgo County record as less than probable—in spite of the fact that it represents a considerable range extension. In addition, it is the only ferret record that we have in a black-tailed prairie dog town in the state west of the Rio Grande.

The Lea County ferret record (Table 4) has been treated elsewhere (e.g., Hubbard et al. 1978), and some confusion exists about it—including whether the identity of the specimen was confirmed by the late John E. Wood of New Mexico State University. According to the observer, James Richardson (pers. comm.), he did mount the specimen, but it had been destroyed (in 1955 or 1956) before his first contract (in 1959-1960) with Dr. Wood. Therefore, Wood clearly did not verify the specimen, and Richardson's identification of it as a black-footed ferret was after the fact and based on his recollection.

Other than the fact that the Lea County animal was black-masked, the most salient feature that Mr. Richardson (pers. comm.) recalled in 1983 was that the size of the body

TABLE 4. Unverified records of the black-footed ferret in New Mexico, 1951-1963. (Asterisk indicates report was from or near a prairie dog town; N=number of ferrets; Var=various.)

Year/ ID No.	Date/ Season	N	Location	Observer	Comments Ratings
1953					
1953-1	?	1	New Mexico	Louis Laney	Cahalane (1954). PROBABLE
1954					
1954-2	?	1	Lea Co.; n. of Lovington, in s.w. quarter of Sec. 5 T14S R36E	James Richarson	Shot at night; live-mounted but specimen destroyed in 1955 or 1956. PROBABLE
1950's					
*1950-1	Var	1+	Hidalgo Co.; Summit area, ca. 17 mi. n.w. of Lordsburg	Arnold Baynes	Seen several times, mainly by day; one or more animals rumored to have been shot by target shooters. PROBABLE
1963					
*1963-1	Oct	1-2	Colfax Co.; Raton, s.e. part of town	William Mobley	Seen several times in daytime. POSSIBLE
1960's					
1960-1	?	1	Curry Co.; road outside w. boundary of Cannon A.F.B.	M. M. Snell	Fide James R. Vaught. POSSIBLE

TABLE 4 (End)

1960-2	?	1	Curry Co.; near Ranchvale	James R. Vaught	Seen in daytime. PROBABLE
1960-3	?	1	San Juan Co.; 55 mi. n. of Gallup	Paul Manygoats	Olson (in litt.). INDETERMINATE

was about three times that of a thirteen-lined ground squirrel (Spermophilus tridecemlineatus) --several of which he also live-mounted. Using weight as a rough index of size and Burt and Grossenheider's (1964:107) median value for this rodent, Richardson's animal may have weighed about 588 g. This weight exceeds the maximum for the long-tailed weasels listed by Burt and Grossenheider (op. cit.:61), which is 336 g. By contrast, black-footed ferrets weigh 672-1568 g (Snow 1972), which is obviously greater than the estimated weight of the Lea County animal. However, the latter is much closer to that of the ferret than the long-tailed weasel, and if not fullgrown, it could have been a ferret. We therefore rate this record as probable (Table 4).

In our subjective opinion, we feel that all of these 1951-1963 records may well have been of black-footed ferrets. What reduced their ratings is the lack of details, which relates largely to the length of time that has expired since the animals in question were recorded.

The Period 1964-1977

Contrasted to only seven reports in the previous 13-year period, the present period of eleven years yields 33 ferret records from New Mexico (Table 5)--and we suspect that even more will eventually come to light. Many of these records are vague and largely undetailed, but one in particular is of such high caliber that we regard it as near-proof of the persistence of the black-footed ferret in New Mexico. The record in question is that from Curry County in 1966, in an area in which two previous records come (see Table 4).

The record in question was obtained by James R. Vaught (pers. comm.) along the western perimeter of Cannon Air Force Base. The animal observed was seen from as close as five feet as it traveled 30-40 feet down a bar ditch, closely followed on foot by the observer. Vaught's description of the large size (18 to 24 inches in total length), color, and pattern of the animal fit the black-footed ferret very closely. Equally significant, Vaught--although a teenager at the time--had owned, raised, and hunted with European ferrets for several years. He was also familiar with the long-tailed weasel--of which a "bridled" race (M. f. neomexicana) occurs in the area--and he estimated that the animal he saw was four times the bulk of that species. This record of the black-footed ferret, which we rate as highly probable, was not in a prairie dog town, although these animals were present within a mile of the sighting.

A second Curry County record in this period is more difficult to evaluate, that being of an animal seen just south of Cannon Air Force Base on August 21, 1977 by Santiago Gonzales (Table 5). This observation was of a large, yellowish-brown mustelid with a black mask and white on the nose and forehead. The animal was obviously ferret-sized, as evidenced by a plaster cast taken of its footprints in the mud by the road. Unfortunately, neither the footprints nor the description of the animal eliminate the European ferret. Therefore, we regard the probability about equal that the animal was of the latter species rather than a black-footed ferret, and we rate the record as possible. However, the previous possible to highly probable records of black-footed ferrets in the general area are relevant here--especially Vaught's 1966 record. Taken as a whole, the Curry County data suggest that a population of black-footed ferrets may have existed in that area at least as recently as 1966, if not 1977.

TABLE 5. Unverified records of the black-footed ferret in New Mexico, 1964-1977. (Asterisk indicates report was from or near a prairie dog town; N=number of ferrets; Aut=autumn, Sum=summer, Var=various.)

Year/ ID No.	Date/ Season	N	Location	Observer	Comments Ratings
1964-68					
1964-1	?	?	San Juan Co.; Sanostee area	Unknown	Kontz (ms.). INDETERMINATE
1964-2	?	?	McKinley Co.; near Manuelito	Herbert K. Morgan	Kontz (ms.). INDETERMINATE
1965					
1965-1	?	1	Socorro Co.?; Magdalena area ?	Luther A. Turner	Fide Walter Snyder. Road-kill; Turner later identified it as a long-tailed weasel. ERRONEOUS
1966					
1966-1	1	1	Curry Co.; road outside w. boundary of Cannon A.F.B.	James R. Vaught	Seen in daytime. HIGHLY PROBABLE
1968					
1968-1	Sum	1	San Juan Co. (or Arizona ?); near Whiskey Lake	Fred Denetdale	Olson (in litt.). INDETERMINATE
1969					
1969-1	?	1	Cibola Co.; between Ramah and the Zuni Mts.	Robert Pino	Fortenbery (ms.). POSSIBLE
1969-2	?	1	San Juan Co.; near Sanostee toward the Chuska (?) Mts.	Vernon Washburn	Kontz (ms.). INDETERMINATE
1970					
*1970-1	?	1	McKinley Co.; near Manuelito	Herbert K. Morgan	Fortenbery (ms.). POSSIBLE

TABLE 5 (Continued)

*1970-2	May 30	1	Sandoval Co.; Valle Grande, Baca Land Grant	David Shaffer, Al Hues, Art Maines	Seen in daytime. PROBABLE
1970-3	May, Jun	1	Curry Co.; near Clovis	Bob Wallace, Hoyt Pattison	INDETERMINATE
1971					
1971-1	Jul 10, 21	1	Colfax Co.; Philmont Scout Camp	T. W. Swedine	POSSIBLE
*1971-2	Sep 9	1	Colfax Co.; Raton, s.e. part of town	Unknown	Spalsbury (in litt.). Seen in daylight. QUESTIONABLE
1971-3	?	?	Rio Arriba Co.; highway 64, entering Carson National Forest from Jicarilla Apache Reservation	Fred Bixler	Fide Richard Cook. INDETERMINATE
1972					
1972-1	Aug 9	1	Colfax Co.; Philmont Scout Camp	T. W. Swedine	POSSIBLE
1973					
1973-5	?	1	Torrance Co.; 2 mi. n.e. of Mountainair	Jettie A. Sullinger	INDETERMINATE
1974					
1974-1	Jul 3	1	DeBaca Co.; near Ft. Sumner	David Sikes	Fide Norma Ames. INDETERMINATE
1974-2	Sep 1	1	Sandoval Co.; Jemez Mts., ½ mile upstream from Las Vacas Campground	Ms. R.E. Brooks	Observed in daytime. POSSIBLE

TABLE 5 (Continued)

1974-3	Sep 1	1	Santa Fe Co.; 1-2 mi. n. of La Bajada village	Clem Rivera	Observed in daytime. INDETERMINATE
*1974-4	Jun 18	1	San Juan Co.; Sanostee	R.F. Kontz	Kontz (mss.). Observed at night; also observed possible ferret "sign" May 16, Jun 11, 18, 21. POSSIBLE
1974-7	Nov	1	Otero Co.; Dry Canyon area	John W. Evans	Seen at dusk. POSSIBLE
1975					
1975-1	Late Jun	1	Otero Co.; near Sunspot, 15 mi s. of Cloudcroft	Donald Rathbun	INDETERMINATE
1975-2	Aut	1	Colfax Co.; 3 mi. w. of Springer	Frank Burton	Animal dead in stock tank. QUESTIONABLE
1975-3	Jul	1	Sandoval Co.; mesa w. of Cuba, ca. 1 mi. w. of Carson National Forest boundary.	Randy Johnson	INDETERMINATE
1975-76					
1975-4	?	1	Lea Co.; vicinity of Lovington	Carl Hennington	Roadkill; specimen later found to be a long-tailed weasel. ERRONEOUS
1976					
1976-1	Var	1	Curry Co.; 9 mi. n. of Melrose	J. M. Vineyard	Fide Ron Porter. POSSIBLE

TABLE 5 (End)

*1976-2	Jul 23	1	Rio Arriba Co.; El Rito	Fabian Garcia	POSSIBLE
1977					
1977-1	May 1	1	San Juan Co.; T23N R21W Sec. 20	Scott Berger	INDETERMINATE
*1977-2	Jul 25	1	Union Co.; 4 mi. n. of Des Moines on highway 72	David Green	POSSIBLE
1977-3	Aug 21	1	Curry Co.; 1¼ mi. s. of south gate to Cannon A.F.B.	Santiago Gonzales	Seen in daytime; plaster cast made of foot-prints. POSSIBLE
1977-4	Oct	1	Otero Co.; La Luz gate to Holloman A.F.B., ca 3 mi. w. jct. highways 5470 and 545	Floyd D. Amburgey	INDETERMINATE
1977-5	Jun, Jul	1	San Miguel Co.; Terrero, on Klauser property	Keith La Rose	POSSIBLE

Another record that we consider of special significance from this period is one from Valle Grande, Sandoval County, on May 30, 1970 (Table 5). The site of the record is in the Jemez Mountains, in the largely grass-covered floor of an ancient caldera. The lowermost elevation of the valley is about 8600 feet, and the grassland there is surrounded by unbroken forest. The animal in question was seen at 25-50 yards through a 4X rifle scope and a 7X50 binocular by three observers who were target-shooting Gunnison's prairie dogs. The description fits the black-footed ferret, although the animal was seen fleetingly. Our rating of the record as probable is somewhat conservative, and we feel the likelihood is good that the animal actually was a black-footed ferret. The type of long-tailed weasel that occurs in the area is an "unbridled" race, i.e., M. f. nevadensis. An ancillary report of a ferret from this mountain range comes from the vicinity of Las Vacas Campground, Sandoval County, in September 1974 (Table 5). In that instance, Mrs. R. E. Brooks saw an animal that we judge could possibly have been a black-footed ferret. This locality is about 25 miles northwest of the Valle Grande site discussed above.

In addition to the records already discussed, we rate nine others from this period as possible. The remaining fifteen records are rated as indeterminate, questionable, or erroneous (Table 5). The most notable records not already discussed are a group of nine from on and near the Navajo Reservation (San Juan, McKinley, and Cibola counties). We rated these as either possible or indeterminate, and they were accumulated mainly by Fortenbery (ms.) and Kontz (mss.). While certainly not definitive, this number of records alone is suggestive evidence that northwestern New Mexico may still harbor black-footed ferrets. As a note of caution, let us point out that the Navajo Reservation may appear to be ideal for ferrets, because prairie dogs remain relatively numerous in many areas. However, the reservation and its vicinity were also subject to massive control programs at times, and therefore the lot of ferrets there has not been without its share of trauma.

There are two erroneous records of black-footed ferret for this period (Table 5). One is of a long-tailed weasel in the Socorro County area in 1965, and the other is of the same species in Lea County in 1975-1976. Both records involved specimens, which shows that even in hand, Mustela frenata is easily confused with the black-footed ferret.

At this point, we introduce a new type of record--that being one in which no ferret is seen, but "sign" is found. The latter can be in the form of trenches, plugged burrows, tracks, scat, prey remains, and other evidence that may be left by ferrets--typically in prairie dog towns. Such records are difficult to assess, but we feel that they should be included nonetheless. "Sign" records for this and later periods are outlined in Table 6, and ratings are applied as in other records.

The Period 1978-1982

This period encompasses two statewide campaigns by the New Mexico Department of Game and Fish to publicize the plight of the black-footed ferret and to solicit records of it from the state. The first campaign was conducted by the Department in 1978-1981 and the second in 1982. The latter was done in conjunction with the Bureau of Land Management, and it is summarized later in this report. These campaigns, coupled with a growing interest in the black-footed ferret nationwide, no doubt account for the increase in reports of the species in the period (Table 7). In all, these totaled eight in 1978, 10 in

TABLE 6. Reports of possible "ferret sign" in prairie dog towns in New Mexico, 1973-1982.

Year/ ID No.	Date/ Season	N	Location	Observer	Comments Ratings
1973					
1973-1	Jun-Aug		Rio Arriba Co.; Coyote Rngr. Dist.	Mark A. Pierce	Pierce (1973). INDETERMINATE
1973-2	Jun-Jul		Rio Arriba Co.; Espanola Rngr. Dist.	Mark A. Pierce	Pierce (1973). INDETERMINATE
1973-3	Jul-Aug		Sandoval Co.; Cuba Rngr. Dist.	Mark A. Pierce	Pierce (1973). INDETERMINATE
1973-4	Jun-Jul		Santa Fe Co.; Tesuque Rngr. Dist.	Mark A. Pierce	Pierce (1973). INDETERMINATE
1974					
1974-5	Jun 11-12		San Juan Co.; Burnham-Farmington	R. F. Kontz	Kontz (ms.). INDETERMINATE
1974-6	May 28		San Juan Co.; Bisti area	R. F. Kontz	Kontz (ms.). INDETERMINATE
1976					
1976-3	Feb 6		Roosevelt Co.; w. of Kenna	J.P. Hubbard, M.C. Conway	Photographed. POSSIBLE
1978					
1978-10	Summer		McKinley Co.; Mt. Taylor area	Wendy M. Brown	Brown (ms.). INDETERMINATE
1978-11	Summer		McKinley Co.; La Jara Mesa	Wendy M. Brown	Brown (ms.). INDETERMINATE
1978-12	Summer		McKinley-Cibola cos.; Cottonwood Canyon Zuni Mts.	Wendy W. Brown	Brown (ms.). INDETERMINATE

TABLE 6 (End)

1978-79				
1978-6	Dec 20, Jan 8-9 Apr 16	Cibola Co.; Zuni Res., ¼ mi. n. of Nutria Lake #4	Brian Hanson	Robert Pacific (in litt.); photographed. POSSIBLE
1981				
1981-8	Jul 29-Nov 27	Rio Arriba Co.; Jicarilla Apache Reservation	Jack F. Cully, Jr.	Cully (1981); photographed. QUESTIONABLE
1982				
1982-23	Mar 8+, Sep 1-2	Rio Arriba Co.; Jicarilla Apache Reservation	Curtis J. Carley et al.	Carley (in litt.). INDETERMINATE

TABLE 7. Unverified records of the black-footed ferret in New Mexico, 1978-1982. (Asterisk indicates report was from or near prairie dog town; N=number of ferrets; Aut=autumn, Spr=spring, Sum=summer, Win=winter.)

Year/ ID No.	Date/ Season	N	Location	Observer	Comments Ratings
1978					
1978-1	Apr	1	Bernalillo Co.; Kirtland A.F.B.	Jim Everheart	Seen in daytime. QUESTIONABLE
1978-2	?	1	Torrance Co.; near Mountainair	Rolf Wagner, Mrs. Wagner	James E. Johnson (in litt.). POSSIBLE
1978-3	Jun 12	1	Torrance Co.; 2 mi. n.e. of Mountainair	Jettie A. Sullinger	Seen in daytime. INDETERMINATE
*1978-4	Jul	2	Torrance Co.; s.e. of Edgewood	Johnny Nieto	POSSIBLE
1978-5	?	1	Santa Fe Co.; Edgewood area ?	Mike Jones	QUESTIONABLE
1978-7	Jun, Jul	1	San Miguel Co.; Terrero, on Klauser property	Keith La Rose	POSSIBLE
1978-8	?	1(+)	Cibola-McKinley cos.?; Zuni Mts.?	Unknown	Wendy Brown (in litt.). INDETERMINATE
1978-9	?	1	Rio Arriba Co.; hill s. of Tierra Amarilla	Joan Jennings	POSSIBLE
1979					
*1979-1	Mar or Apr	1	Chaves Co.; Bitter Lake N.W.R.	Cass Mason	Seen in daytime. POSSIBLE
1979-2	Jun 24	1	Chaves Co.; Roswell, Goddard High School	Ken Stolte	POSSIBLE

TABLE 7 (Continued)

1979-3	Aug	2	Roosevelt Co.; 14 mi. s.e. of Portales on highway 82	Howard Powers	QUESTIONABLE
*1979-4	Aug	1	Valencia Co.; between Jarales and Pueblito	Paul Ridley	POSSIBLE
1979-5	Sep 29	1	Bernalillo Co.; Sandia Mts., ca. ½ mi. above Capulin Spring	William R. Johnson	QUESTIONABLE
1979-6	Aut	2	Lea Co.; 2½ mi. e., 2½ mi. n. of Jal	Jerry Ross	QUESTIONABLE
1979-7	Dec 1	1	Chaves Co.; 2 mi. e. of Spring River Park	Victor Whitmore	QUESTIONABLE
1979-8	?	1	Eddy Co.; near Lakewood, e. of Pecos River	Ralph Schaffer	QUESTIONABLE
1979-9	?	1	Chaves Co.; Roswell, at old airport	Unknown	Fide Bruce Morrison. Seen in daytime; photographs show long-tailed weasel. ERRONEOUS
*1979-10	?	1(+)	Chaves Co.; East Grand Plains	Richard Davis	Fide Bruce Morrison. INDETERMINATE

TABLE 7 (Continued)

1970's (?)					
1970-4	?	1	Sandoval Co.; 5 mi.n.e. of Pueblo Alto	Allen Crockett	INDETERMINATE
1970-5	?	1	San Juan Co.; Chaco (Canyon)	Unknown	Sverdrup & Parcell and Assoc. (1981). INDETERMINATE
1980					
*1980-1	Jan-Feb	2	Curry Co.; 9 mi. n. of St. Vrain	Richard Miller	Seen in daytime. QUESTIONABLE
*1980-2	Spr	2	Roosevelt Co.; w. of Melrose	James E. Dickenson	Found dead; skin of one a long-tailed weasel. QUESTIONABLE & ERRONEOUS
1980-3	Jan	1	Dona Ana Co.; s. of Radium Springs	Phillip O. Rice	INDETERMINATE
1980-4	May 15	1	Otero Co.; s. of highway 70 on White Sands Missile Range	Thomas A. Todsen	INDETERMINATE
1980-5	Jul 7	1	Eddy Co.; ca. 10 mi. w. of Artesia	John Wortley, Ralph Schaffer ?	QUESTIONABLE
1980-6	Late sum	6-7	Otero Co.; 10-15 mi. e. of Alamogordo, Fresnal Canyon area	Ron Ratkevich, Brad Hill	Seen in daytime; 2 adults, plus 4-5 young. QUESTIONABLE

TABLE 7 (Continued)

*1980-7	Aug 10	1	Torrance Co.; 1-1½ mi. s. and 3-4 mi. w. McIntosh	Dave Garcia, Mike Dewalt	Seen in daytime. QUESTIONABLE
1980-8	Aug	1	Bernalillo Co.; Albuquerque (s.e. area)	Daniel Wilson, Gene Wilson	Drowned in a swimming pool; photographed (not seen). POSSIBLE
*1980-9	?	1(+)	Chaves Co.; East Grand Plains	Richard Davis	Fide Bruce Morrison. INDETERMINATE
1980-10	Oct 24	1	Torrance Co.; ca. 1 mi. w. of Clines Corners on I-40	Richard L. Hanson	Seen in daytime. QUESTIONABLE
1980-11	Early Aug	1	San Miguel Co.; Terrero, on Klauser property	Keith La Rose	POSSIBLE
1980-12	?	1	McKinley Co.; 10 mi. n.w. of Crownpoint	Mrs. Atsiti	Souris (ms.). INDETERMINATE
*1980-13	Sep	1	Mora Co.; Ft. Union National Monument	John Shuster	POSSIBLE
1980-14	Dec 1	1	Taos Co.; Middle Road, Taos	Barbara E. Devine	INDETERMINATE
1980-15	Jul 14	1	Rio Arriba Co.; ca. 1 mi. above the Wilson Ranch bridge, on road from Canjilon to Vallecitos	Richard Swords	Seen in daytime. POSSIBLE

TABLE 7 (Continued)

*1980-16	?	?	Chaves Co.; East Grand Plains	Richard Davis	Fide Bruce Morrison. INDETERMINATE
1981					
1981-1	Jan	2	Cibola Co.; Floyd Lee Ranch, n. side of Mt. Taylor	Danny Elkins	Mike Bodenchuk (in litt.); spotlighted at night. INDETERMINATE
1981-2	Early	2	Eddy Co.; Guadalupe Mts., ½ mi. s. Home Well, on road to National Ranch	Mary Woodward	Seen in daytime. QUESTIONABLE
1981-3	Sum?	1	Bernalillo Co.; Albuquerque—Southern Ave., s. of Central Ave.	Lauren Gibson	Seen in daytime. QUESTIONABLE
*1981-4	Sum, Aut	1	Cibola Co.; Chaves Grant, San Mateo Mesa near Tom Marquez Ranch	Joe Truby	Seen in daytime. POSSIBLE
1981-5	Jul?	1	Lincoln Co.; near Alto, 8,000 Ft.	E. Sager, Mrs. Sager	Seen in daytime. QUESTIONABLE
1981-6	Aug	1	Grant Co.; ca. 5 mi. s. of Mimbres Ranger Station	Jake Osborn, Mrs. Osborn	Seen in daytime. POSSIBLE
1981-7	Aug?	1	Eddy Co.; NM 6 between Lake Arthur and Artesia, ca. milepost 5	Stuart Prichard	Seen in daytim.e POSSIBLE

*1981-9	Sep, win	2	Colfax Co.; 1 mi. w. of Angel Fire airport	Larry Daws, Tommie Daws	Seen in daytime. PROBABLE (Sep); QUESTIONABLE (Win)
*1981-10	Oct 1	3	Curry Co.; 3 mi. w. of Melrose, highway 60-84	William P. Burdette	Seen in daytime. QUESTIONABLE
*1981-11	Aug 5	1	Socorro Co.; 6-7 mi. w. of Magdalena, highway 60	James Tunnell	Seen in daytime. POSSIBLE
1981-12	Aut	1	Sandoval Co.; Fenton Lake	David A. Walker	Seen at dusk. QUESTIONABLE
*1981-13	Jul or Aug	1	Taos Co.; Middle fork of Red River Lake	Tayor Streit	Later identified as long-tailed weasel. ERRONEOUS
*1981-14	Sum, Nov 27, Dec 13	1	Sandoval Co.; Sandia Indian Reservation, s. of Bernalillo on highway 85	Michael Pandolfo	Seen in daytime. POSSIBLE
1981-15	Dec	1	Torrance Co.; Punta de Agua	Mrs. Caster	Seen in daytime. QUESTIONABLE
1981-16	Dec	1	Guadalupe Co.; 20 mi. e. of Santa Rosa	Johnny Martinez	Animal killed in hen house; pelt that of European ferret (T.L. Best pers. comm.). ERRONEOUS

TABLE 7 (Continued)

1981-17	?	1	Otero Co.; 1½ mi. up Haynes Canyon, Sacramento Mts., 7600 Ft.	Ken Holland, Peggy Holland	Animal found on porch. QUESTIONABLE
*1981-18	?	1(+)	Chaves Co.; East Grand Plains	Richard Davis	Fide Bruce Morrison. INDETERMINATE
1982					
1982-1	Jan?	1	Santa Fe Co.; ca. 3 mi. s. of Golden	Jesse Colvin	Fide Lowery Seager. Seen in daytime. QUESTIONABLE
1982-2	Mar?	1	San Juan Co.; 6.5 mi. s., 4 mi. w. of the Shiprock	Gordon Rogers	Seen at dusk. POSSIBLE
1982-3	Early Mar	1	Valencia Co.; near Belen, w. of Rio Grande	Joe Lucero, Eddy Lovato, Nary Lovato	Seen in daylight. POSSIBLE
1982-4	Apr 25	1	Bernalillo Co.; Sandia Park area	Michael Scott, Mrs. Scott	Seen in daylight. QUESTIONABLE
1982-5	Early May	1	San Miguel Co.; Pecos River, near Lisboa Springs Hatchery	Steve Garcia	Seen at dawn. POSSIBLE
1982-6	May 13	1	Otero Co.; Alamogordo n. of Boles Acres, on highway 54	Nicholas C. Tarbox	Seen in daylight. POSSIBLE
*1982-7	May 30	1	Rio Arriba Co.; 4 mi. w., 3 mi. n. of Vallecitos	Fred Norwood	Seen in daylight. POSSIBLE
1982-8	Jun 17	1	Valencia Co.; near Belen, 1 mi. s. of highway 85 overpass	Robert Sanchez	Seen in daylight. QUESTIONABLE

TABLE 7 (Continued)

1982-9	Jun 15-27	1	Sierra Co.; ca. 1 mi. s. of Elephant Butte P.O.	A.G. Coburn	Seen in daylight. QUESTIONABLE
1982-10	Jun 22	1	Eddy-Chaves cos.; highway 285, on county line	Kent Bullock	Seen in daylight. POSSIBLE
*1982-11	Jun 23	1	Valencia Co.; w. of Los Chaves	Pat Edeal	QUESTIONABLE
*1982-12	Mid-Jul	1	Bernalillo Co.; Apple Valley area Manzano Mts., on highway 14	Edward Harmon, Rose Harmon	Seen in daylight and at dusk. POSSIBLE
1982-13	Jul 15	1	Eddy Co.; 10 mi. s. of Malaga on highway 285	Greg Stallcup	Seen in daylight. QUESTIONABLE
1982-14	Jul 17	1	Colfax Co.; 20 mi. e. of Raton on highway 72	Willard Louden, Mrs. Louden	Seen in daylight. QUESTIONABLE
1982-15	Aug	2	Curry Co.; n. of Ranchvale	Dave Mardock	Seen in daylight. QUESTIONABLE
1982-16	Aug 2	1	Otero Co.; ca 19 mi. s. of Alamogordo	Lawrence Capizzi	Seen in daylight. QUESTIONABLE
1982-17	Aug 30	1	Eddy Co.; 2½-3 mi. n. of Artesia on highway 285	C. B. McDaniel	Seen in daylight. QUESTIONABLE
1982-18	Aug 19	1	Sandoval Co.; Cuba, n.e. of sawmill	Daniel Valdez	Seen in daylight. POSSIBLE

1982-19	Sep 5	1	Eddy Co.; n. part of Carlsbad, near Orchard Lane	Richard Buck	Seen in daylight. QUESTIONABLE
1982-20	Spr	1	Dona Ana Co.; Las Cruces, jct. Picacho and Rio Grande	Wilda J. Cornell	Seen in daylight. QUESTIONABLE
*1982-21	Jul?	1	Chaves Co.; East Grand Plains	Richard Davis	Fide Bruce Morrison. Animal dead on highway; long-tailed weasel. ERRONEOUS
1982-22	Jun	1	San Juan Co.; between Navajo Dam and Navajo City	Don Easterling	Seen in daytime. POSSIBLE
1982-24	Jul	1-2	Chaves Co.; Roswell, near Goddard High School	Tom Terrll	Seen in daytime. QUESTIONABLE
1982-25	Sep	1	Bernalillo Co.; Sandia Mts., highway 44, Medina Canyon-Capulin Peak area	Ben C. Fetherston	Seen in daytime. POSSIBLE
*1982-26	Late Oct, early Nov	1	Taos Co.; Taos area	Ted Schupback	Fide Ben Kuykendall. POSSIBLE
1982-27	Sep 1	1	Chaves Co.; Roswell	Mike Jones	INDETERMINATE

1979, 16 in 1980, 18 in 1981, and 26 in 1982.

Of the 78 records from the period, only one is rated as high as probable. The remainder comprise 27 possible, 12 indeterminate, 33 questionable, and five erroneous records . The record that we rate as a probable black-footed ferret is one obtained by Larry and Tommie Daws (pers. comm.) in Colfax County, one mile west of Angel Fire airport in the Moreno Valley. The date in question is September 1981, and the description of size, color, and pattern fit the species well. Interestingly, Aldous' (1940) 1929 record of three ferrets (one collected) was very near the present locality. In addition, Gunnison's prairie dogs are common in the Moreno Valley, including near the site of the 1981 record. The Davis' also refer to a similar animal that was seen in the area later in the winter of 1981-1982. However, this report probably refers to a weasel in winter pelage, and it may have been a different animal than that seen in September.

We suspect that others of the 1978-1982 records may actually be of black-footed ferrets, but most probably are not. Of the records that we questioned, the majority almost certainly refer to long-tailed weasels—mainly the bridled type. The erroneous records reported as black-footed ferrets are of the European ferret and long-tailed weasels. The former includes the previously discussed 1981 record from Guadalupe County, while weasels were misidentified as black-footed ferrets in four cases (Table 7). The latter involved records from Curry County in 1980 and Chaves County in 1979 and 1982 and Taos County in 1981. The Curry County record was of two animals that were found dead west of Melrose. The retained pelt of one of these animals is definitely that of a weasel, and we suspect that both animals were of this species.

The absence in this period of more reliable reports of black-footed ferrets could be viewed as disappointing, in view of the publicity campaigns and increased submission of records by the public. However, the lack of solid leads following such campaigns has been the usual experience in other states, and this approach has not—to our knowledge—yet led to the discovery of viable populations of ferrets. We have already made the point that most of the reliable records of black-footed ferrets from New Mexico were obtained by trappers and other people who spent considerable time around prairie dog colonies. The records that do not fall into these categories were largely the result of fortuituous circumstances, and almost all were the product of the alertness and biological expertise of the observers. To expect this set of circumstances to change, just because of publicity and increased public awareness, is not realistic. Nonetheless, we are hopeful that fortuitous circumstances will recur and that one or more ferrets will come to light in the state as a result of efforts such as those in 1978-1981 and 1982.

Summary of Records for the Period 1951-1982

We accumulated some 118 records of the black-footed ferret in New Mexico in the period 1951-1982 (Tables 4,5,7), plus 13 records of possible ferret "sign" (Table 6). The summary of ratings for the records of animals seen (Table 8) reveals that only one (0.8%) rated as highly probable and six (5.1%) rated as probable. The highly probable record was from Curry County in 1966, while the probable records were from Hidalgo County in the 1950's, Lea County in 1954, Curry County in 1960, Sandoval County in 1970, Colfax County in 1981, and county not specified in 1953. Records that do not or probably do not

TABLE 8. Ratings of records of black-footed ferrets from New Mexico, 1951-1982, excluding reports of "sign" only. (N=number of records.)

PERIOD	N	RATINGS OF RECORDS BY PERIOD (AS PERCENTAGES)					
		HIGHLY PROBABLE	PROBABLE	POSSIBLE	INDETER-MINATE	QUEST-IONABLE	ERRON-EOUS
1951-63	7	3.0	57.1	28.6	14.3		
1964-77	33		3.0	33.3	42.4	12.1	6.1
1978	8			50.0	25.0	25.0	
1979	10			30.0	20.0	40.0	10.0
1980	16			25.0	31.2	37.5	6.3
1981	18		5.6	27.8	11.1	44.4	11.1
1982	26			42.3	3.8	50.0	3.8
1978-82	78		1.3	34.6	15.4	42.3	6.4
Overall	118	0.8	5.1	33.9	22.9	31.4	5.9

pertain to this species totalled 44 (37.3%), of which 31.4% are questionable and 5.9% are erroneous. These doubtful records probably refer mostly to long-tailed weasels, although in some cases European ferrets were or may have been involved. Possible records of black-footed ferrets totalled 40 (33.9%) overall, and this level held fairly steady for each segment of the period: 28.6% for 1951-1963, 33.3% for 1964-1977, and 34.6% for 1978-1982. Indeterminate records amounted to 27 (22.9%) overall, but improved detailing reduced this category from 42.4% in 1964-1977 to 15.4% in 1978-1982.

Implications of the Records for the Period 1951-1982

The major implication from these records is that valid sightings of the black-footed ferret were apparently quite infrequent in New Mexico in the period 1951-1982. However, this finding alone does not necessarily mean that the species was equally infrequent, i.e., extremely rare or local in the state. For example, recall that only one record of the ferret accumulated in the state in the period 1889-1914--in spite of the extensive work done here by the Bureau of Biological Survey and the likelihood that ferrets were probably rather numerous and widespread. By the same token, unreliable records of ferrets might have been as frequent then as now, had the interest been there for seeking and reporting the species. Indeed, we suspect that unreliable reports might well have been proffered in past years, only to have been subsequently lost to our sight. Be that as it may, our point is that overlooked ferrets may well remain in New Mexico, and the present negative evidence is no reason to abandon the search.

Given that only 5.9% of the New Mexico records for the period appear to be reliable enough to apply to the black-footed ferret, one would not expect from them any significant additions to our understanding of the species' status in the state. However, two from this group of records indicate a distribution in areas not suggested by earlier data, i.e., in the high Valle Grande of the Jemez Mountains (Sandoval County) and in the Sub-Mogollon region of the southwest (Hidalgo County). Both of these sites are in grassland areas, and both supported prairie dogs--Gunnison's and black-tailed, respectively--at the time of the records. The other three records are either in (Colfax County) or near (Curry and Lea counties) from the known or expected range of the ferret in New Mexico.

DISTRIBUTION IN THE PERIOD 1899-1982

We have accumulated a total of 151 records of the black-footed ferret in New Mexico for the period 1899-1982 (Tables 2, 5, 7, 8), plus an additional 13 records of possible ferret "sign" (Table 6). Many of the records in the former group are unreliable in nature, as some are either erroneous (i.e., 7 records) or questionable (38 records). At the other end of the spectrum are 33 reliable records, i.e., those rated as positive (10), highly probable (10), and probable (13). In between in reliability are those records rated as possible (43), while the 30 indeterminate records are ones that we cannot rate more specifically because of the lack of sufficient detail. The records of possible "sign," while more difficult to assess, fall into questionable (1), indeterminate (10) and possible (2) categories.

In our view, the most conservative determination of the historic distribution of the

black-footed ferret in New Mexico is that based on the 33 most reliable records. Using these, the ferret can be attributed to 14 of New Mexico's 33 counties (Figure 16). Plots of these records show several gaps in the range of the black-footed ferret in the state, most notably in the extreme south, the northeast, and the central regions. We believe that all of these gaps are probably artifacts, except possibly that in the extreme south--especially in and near the Tularosa Basin.

Given that the known historic range of the black-footed ferret in New Mexico has been elucidated through only a small number of records, one might well question our supposition that the species was widely distributed in the state. However, we have already discussed the factors that make difficult the accumulation of good data on this species--including its general elusiveness and the chancey nature of encounters with it. On the other hand, given the distributional and ecological amplitude shown by the ferret over its known range, there is no reason that we can see that all suitable habitat in New Mexico would not have been available to the species--and probably occupied by it. Consequently, we suspect that the historical distribution of the black-footed ferret in New Mexico was probably coextensive with the ranges of prairie dogs (dash-patterned area), as shown in Figure 16. While we may never be able to prove this postulate, we believe it is closer to the truth than are implications of a more limited range.

RECENT EFFORTS TO LOCATE FERRETS

Surveys for the black-footed ferret in New Mexico fall into two categories, one being in the form of publicity campaigns to elicit records and the other being on-the-ground searches for the species--typically in prairie dog towns. These two types are discussed separately below.

PUBLICITY CAMPAIGNS

As indicated earlier, the first statewide publicity campaign on the black-footed ferret in New Mexico was conducted by the Department of Game and Fish in 1978-1981. The focus of that effort was the distribution of posters outlining the plight of the ferret, giving details for distinguishing it from similar species, and soliciting reports (Figure 17). To facilitate the submission of reports, self-addressed but non-franked postcards (Figure 18) were provided at poster locations. These materials received a wide distribution in the state, mainly through the Department's personnel but also through other agencies, organizations, and individuals. The Department also conducted a moderate amount of media publicity, including through its publications (e.g., New Mexico Wildlife) and television program (New Mexico Outdoors). Some 200 posters and 1700 postcards were distributed by the Department in the period 1978-1981. The poster was also displayed and postcards made available at the Department's exhibit at the New Mexico State Fair in September 1979, 1980, and 1981. An estimated 360,000 people visited that exhibit in those years, and many others were exposed to the ferret campaign through the other media.

In 1982 the Department of Game and Fish and the Bureau of Land Management began a second publicity campaign on the black-footed ferret in New Mexico. This campaign was an expanded version of that of 1978-1981, with a poster (Figure 19) again

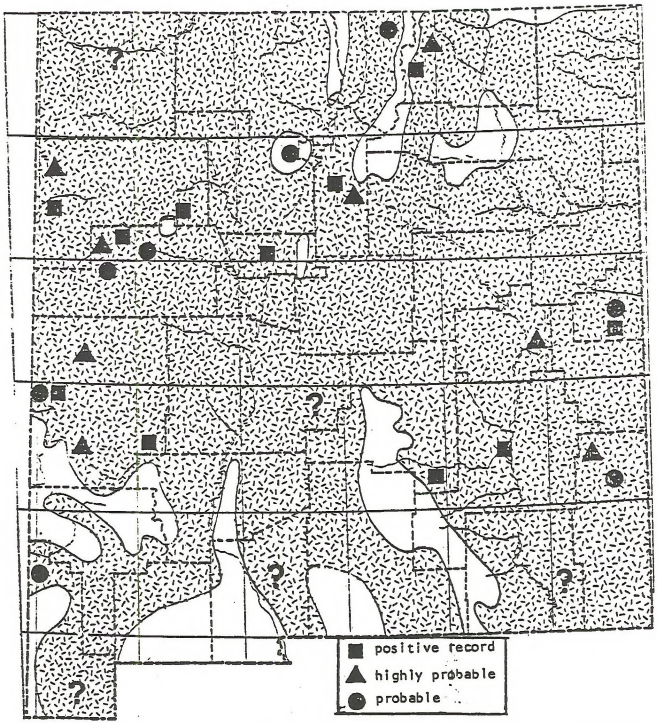
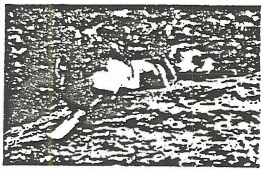


FIGURE 16. Distribution of the black-footed ferret in New Mexico in the period 1899-1982. The dark symbols represent the actual range, based on the most reliable records for the period. The dash-patterned area is the potential range, based on the historic distribution of prairie dogs.

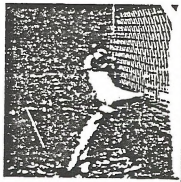


WANTED ALIVE

This is the endangered black-footed ferret (*Mustela Nigripes*); probably the rarest mammal in North America. The ferret is approximately 2 feet long including the tail, has a black face-mask, black tipped tail and black feet. It is most often seen in or around prairie dog towns.

DON'T BE CONFUSED

The animal most commonly misidentified as a black-footed ferret is the long-tailed weasel (*Mustela frenata*). It also has a black face-mask and black tipped tail; but it does not have black feet, is more reddish brown in overall coloration and is about one-half the size of the black-footed ferret.



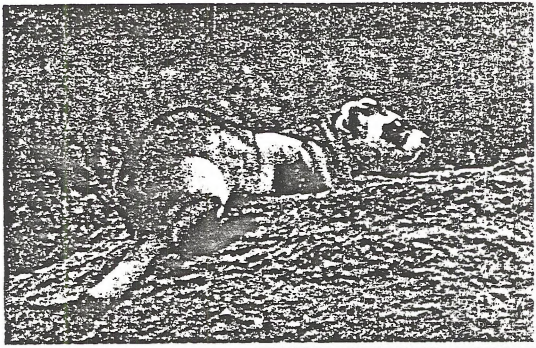
Another member of the weasel family which is about the same size and has markings similar to those of the black-footed ferret is the European ferret (*Mustela putorius*). Released or escaped captives of this species might possibly be seen in or around cities or towns. In general, it differs from the black-footed ferret in having a more pointed muzzle, more black on the tail and bushier fur giving it a heavier bodied appearance.

If you have seen a black-footed ferret, please report it to a biologist with the Department of Game and Fish at the following address:

New Mexico Dept. of Game & Fish
Endangered Species Program
Villagra Building
Santa Fe, New Mexico 87503
Phone 827-2438

FIGURE 17. Copy of poster used in 1978-1981 publicity campaign on the black-footed ferret in New Mexico. The original poster was in color, and it measured 12 x 14 inches.

A



B

The endangered black-footed ferret may be the rarest mammal in North America. Historically, this member of the weasel family occurred in New Mexico where it occupied prairie dog towns and fed almost entirely on prairie dogs.

Your cooperation in reporting sightings of this animal will help the Department of Game and Fish in a program to save the species from extinction.

REPORT OF FERRET SIGHTING

Date_____ County _____

Location _____

_____

_____

Your Name _____

Address _____

_____

Phone No. _____

Place Stamp Here

New Mexico Dept. of Game & Fish

Endangered Species Program

Villagra Building

Santa Fe, New Mexico 87503

FIGURE 18. Front (A) and back (B) of the postcard used for the public to report records of the black-footed ferret in New Mexico, during the 1978-1981 publicity campaign on the species. The front of the postcard is in color, and the copy above is actual size.

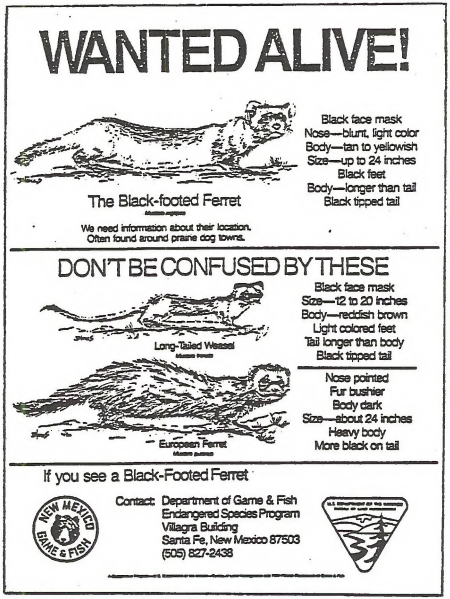


FIGURE 19. Copy of poster used in 1982 publicity campaign on the black-footed ferret in New Mexico. The original poster was black on yellow, and it measured 18 x 24 inches.

the central focus of the effort and postcards (Figure 20) for submission of records. In the period March 16 through April 5, 1982, some 592 posters and 1740 postcards were distributed by Department and Bureau personnel, as well as by the Forest Service, U. S. Fish and Wildlife Service, and others. The new poster was displayed at the Department of Game and Fish exhibit at the New Mexico State Fair in September 1982, and 3600 postcards were provided for public responses. An improvement in the postcard over that of 1978-1981 was the addition of franking, thus avoiding postage charge to cooperators; the card was pre-addressed to the Department.

In addition to the poster/postcard phase of the 1982 publicity campaign, the Department of Game and Fish also staged television and radio programs to publicize the black-footed ferret and the need for any reports of it. The airing of these programs extended from January 31 to May 12, 1982, as shown in Table 9. The projected audiences for these programs were 650,000 to 820,000 people, located in the Albuquerque, Las Cruces, Roswell, Farmington, and most other populations centers in the state. Also part of the media coverage was an article on the ferret in New Mexico Wildlife magazine (Schmitt 1982). This publication has a circulation of about 9,500 households, most of which are in New Mexico. A reduced version of the 1982 poster appeared with the article, which also featured a frontal-view photograph of a black-footed ferret.

We regard the 1978-1981 publicity campaign to have been moderately successful in stimulating observers to submit records of black-footed ferrets in New Mexico. Sixteen (19.7%) of the 81 records received for the years 1978-1982 identified that campaign as the reason for their having been submitted (Table 10). Records attributable to the second publicity campaign totalled 34 (42.0%) through 1982, thus already having far exceeded the total from the 1978-1981 campaign. Responses to the 1982 campaign continue into 1983, and this should go on into the future. These ferret posters and postcards will continue to be displayed widely in the state, as they were at the New Mexico State Fair in September 1983.

The Department of Game and Fish has improved its responses to ferret reports from the 1978-1981 campaign to that initiated in 1982. For one thing, each ferret record now is followed up with a telephone interview whenever possible; where this cannot be accomplished, written communications are initiated. In-person interviews are sought for the more promising reports, along with field-visits when these can be arranged. Even greater effort will be expended in these and related matters in the future, and improved illustrative and written materials on ferrets will be distributed as they become available.

We have previously indicated that other states conducting these and similar types of publicity campaigns have had little success through them in finding populations of black-footed ferrets--e.g., in Kansas (Henderson et al. 1969), Oklahoma (Hassien 1976), and Wyoming (Clark 1978). This lack of success is particularly interesting in Wyoming, where a substantial, albeit local, population of ferrets is now known. Nonetheless, as we have also indicated, even though one cannot expect much such success in finding ferrets with this approach, it has real value in sensitizing the public to the plight of the black-footed ferret and its needs. Judging from the response that we have had in New Mexico, we feel that our 1978-1981 and 1982 publicity campaigns have been important successes in fulfilling such goals. If we find a ferret in the process, that will be a welcome bonus.

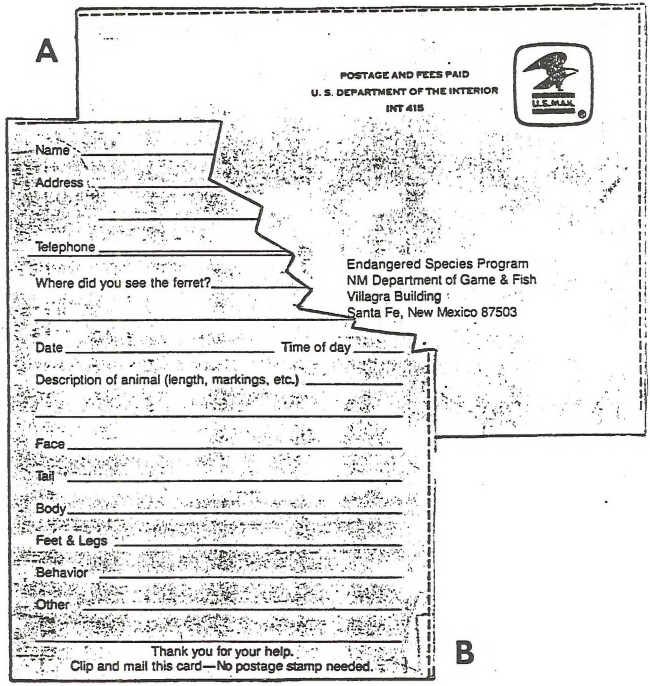


FIGURE 20. Front (A) and back (B) of the postcard used for the public to report records of the black-footed ferret in New Mexico, during the 1982 publicity campaign on the species. The postcard is black on yellow, and the copy is actual size.

TABLE 9. Radio and television programs used during 1982 to publicize the plight of the black-footed ferret and solicit records from the public in New Mexico.

RADIO

Program	Location of Broadcast	Station	Date	Projected Audience
	Statewide	36 different ones	Feb 1-6	200,000
			Subtotal:	200,000

TELEVISION

New Mexico Outdoors	Albuquerque	KOB-TV	Jan. 31	50,000-80,000
	Albuquerque	KNME-TV	Feb. 6	50,000-80,000
	Farmington	KIVA-TV	Jan. 31	50,000-80,000
	Las Cruces	KBIM-TV	Feb. 3	50,000-80,000
	Roswell	KNSU-TV	Feb. 6	50,000-80,000
Action 7 Sports	Albuquerque	KOAT-TV	Apr. 28 or 29	130,000-140,000
Noon and News Spot	Albuquerque	KGGM-TV	May 5 and 12	70,000-80,000
			Subtotal:	450,000-620,000
			Grand Total:	650,000-820,000

TABLE 10. Reasons noted by observers for their submission of records of black-footed ferrets in New Mexico, 1978-1982. (N=numbers of records.)

Year of Record	N	REASONS GIVEN FOR SUBMISSION OF RECORDS (%) 1978 Publicity Campaign[1]	1982 Publicity Campaign[2]	Other Reasons[3]	None Given[4]
1978	8	25.0	12.5	37.5	25.0
1979	11	27.3	9.1		63.6
1980	16	37.5	25.0	12.5	25.0
1981	20	20.0	60.0	5.0	15.0
1982	26	3.8	61.5	3.8	30.8
Overall Totals	81	19.7	42.0	8.6	29.6

[1]This campaign began in 1978 and continued actively into 1981.

[2]This campaign obviously stimulated observers to submit unreported records predating 1982; some of these records were also reported in the 1978-1981 campaign.

[3]This includes media coverage independent of the 1978-1981 and 1982 campaigns, biological investigations and so on.

[4]This category includes a large number of people who either did not respond to or were not contacted in followups. Undoubtedly some of these reports would be assignable to one of the other categories, if more data were available.

FIELD SURVEYS

Without question, many thousands of dollars, man-hours, and other resources have been devoted in recent years to so-called "black-footed ferret surveys." Unfortunately, most of these were probably "ferret" surveys in name only, as various deficiencies and/or other problems may have made their prospects of locating this animal almost negligible from the start. In view of our earlier discussion, it is not surprising that so much of the effort directed toward these surveys has been improductive. Even where well-conceived and executed, the likelihood of success in finding ferrets is dimmed by the very nature of the beast—nocturnal, subterranean, and now apparently at least very local in distribution if not quite rare. When not well-conceived and/or executed, such surveys would probably have been of more value to the conservation of ferrets not to have been done at all.

New Mexico has had its share of unproductive ferret surveys, including some that were laudable in purpose and genuine in their effort. However, in our view, few if any of these surveys has really made even a good circumstantial case that the black-footed ferret was absent at the time that an area was examined. This especially the case in which large acreages of prairie dogs have been surveyed in a short time, e.g., as a prelude to control of these rodents. For example, we find it impossible to believe that the 139,000 acres examined for this purpose in the period 1969-1971 (Victor Garcia pers. comm.) could have been considered as adequately surveyed for ferrets.

Lest we convey the impression that we regarded any ferret survey efforts by the Department of Game and Fish as having been particularly splendid, let us dispell that notion; they have not. Nor do we belittle the efforts expended by so many people who braved the heat, cold, dust, rain, snow, wind, and other tedious conditions to survey prairie dog towns for ferrets. Most people that we know who have done these surveys have tried their best under the circumstances they faced. However, "best" is not enough in the case of the black-footed ferret—we must do better, for an evolutionary line hangs in the balance.

We have already alluded to the recently revised methods of Clark et al. (1982) for black-footed ferret surveys, and we recommend that these be adopted, expanded, and improved for work in New Mexico. In particular, we have already discussed modifications that we feel are needed to survey in prairie dog towns that are slated for control. We also are hopeful that the concept of using trained "sniffer" dogs will be revived to locate ferrets. While the Department's initiative in this endeavor in 1978-1981 (Dean 1979) did prove fruitful, we are still convinced that the concept is feasible and should be resurrected. If dogs can sniff out bombs, drugs, and all kinds of game, we cannot believe that they are incapable of reliably locating ferrets as well.

Besides the obvious need for surveys to locate black-footed ferrets, we also believe that a chronic need exists to understand prairie dogs better. In our view there are many gaps in the data on these rodents that relate importantly to the black-footed ferret and its conservation. We have already alluded to some of these, including the very basic question of prairie dog impacts on forage plants that are also used by livestock. Until this

subject is properly elucidated, there will be a tendency for different user groups to be polarized in their outlook on these rodents—i.e., those that are for them and those against. Even after the matter has been properly investigated, polarity in views may still exist. However, if polarity must persist—and it seems to be the human condition—at least let it be based more on data than opinion.

Another important matter for investigation in prairie dogs is that of their population's dynamics, complete with studies of the causes for shifts in range, numbers, and related factors. Sylvatic plague is a serious impact to measure in this context, given that it may be less subject to man's oversight than are such things as control programs. Concomitantly, we must also probe the possibility of protecting prairie dog populations from plague, so that enough of the animals will remain to support ferret populations. Related to this are questions such as those probed by Stromberg et al. (1983), regarding the population sizes of these rodents that are needed to support viable populations of ferrets.

Prairie dog management must be viewed as central to ferret management, until and unless proven otherwise. In this context, to conserve prairie dogs is to conserve ferrets, and we strongly recommend that steps to conserve prairie dogs be taken as soon as possible—especially on public lands. In this regard, studies by such workers as Ruffner et al. (1980) are worthy of emulation and expansion. In the meantime, a much more balanced view toward prairie dogs should be adopted. These animals have a rightful place in the ecosystem, and failure to provide for this is a failure at proper management—whether multiple use oriented or not.

SUMMARY AND CONCLUSIONS

The black-footed ferret, Mustela nigripes (Audubon and Bachman), has been a denizen of New Mexico since at least the late Wisconsinan and probably through the entire latter part of the Pleistocene epoch. The first historical record appears to have been at Roswell in 1899, when a left dentary bone was found by Vernon Bailey. The next record was not until 1915, even though the Bureau of Biological Survey began conducting intensive studies of the mammals of the state as early as 1889. Rather than indicating rarity, we feel that the dearth of records during those early Biological Survey years (1889-1914) indicates that ferrets were too elusive to be detected by the traditional methods of mammalian inventory and thus escaped discovery.

From 1915 to 1918 there accumulated seven records of the black-footed ferret from New Mexico, including four extant museum skin specimens. Based on the available data, we suspect that all of these records were the direct result of predator-trapping operations. Whether such trappers intentionally took ferrets or not, we believe that theirs was the first and probably one of the few reliable means of assaying for the presence of this species.

Most, if not all, of the subsequent five ferret specimens extant from New Mexico were probably also trapped, these dating from 1925 to 1934. However, three alleged specimens, taken in the period 1937-1954 and lost or destroyed, were victims of shooting, vehicle-collision, or drowning. Many of the other reliable records of ferrets were also of

animals that were either trapped or were observed by people engaged in prairie dog control. The few others were the result of chance encounters, typically by good observers and/or persons with wildlife backgrounds.

Although the last of the extant museum specimens (N=10) of the black-footed ferret was taken in New Mexico in 1934, highly probable records (N=10) occurred perhaps regularly in the state into the 1940's and as late as 1966. Probable records (N=13) of the species persisted into the 1960's, with one each in 1970 and 1981. While the available habitat (i.e., prairie dog towns) for ferrets has been greatly reduced in New Mexico, we believe that the species still likely occurs here. The scarcity of recent, highly reliable records of ferret is probably due, in large part, to the animal's elusiveness, and we harken back to the poor success that the Bureau of Biological Survey had in finding the animals between 1889 and 1914—when the species was probably both reasonably widespread and numerous.

The range of the black-footed ferret in New Mexico in earlier historic times probably extended statewide where there were prairie dogs, except that there is no specimen and only one record south of the Mogollon Plateau and none in the Tularosa Basin—where black-tailed prairie dogs were at least locally common. These absences may be more apparent than real, as ferrets in New Mexico showed a wide tolerance of environmental conditions—from the eastern plains to middle-elevation intermontane basins and even elevated montane valleys at 8000+ feet above sea level.

The collapse of the ferrets' world occurred largely as a result of man's control of prairie dogs, an effort that extended from 1914 to the present. Major efforts at controlling animals such as prairie dogs occurred in New Mexico in the years 1919-1922, 1930, 1935-1938, 1941-1942, and 1953; however, after 1941, acreages treated to control prairie dogs declined to relatively low levels. This decline is directly related to that of the prairie dogs themselves, which were estimated to occupy almost 12,000,000 acres in the state in 1919—versus less than 500,000 acres in 1979-1981.

Publicity campaigns on the black-footed ferret in New Mexico were conducted by the Department of Game and Fish in 1978-1981 and by the Department and the Bureau of Land Management in 1982. While these campaigns did increase the number of reports of ferrets, few of the 78 records in the period 1978-1982 appear actually to be of that species. The lack of success in locating ferrets by this method is not surprising, in view of similar failures in other states—including Wyoming, where a local but substantiated population was subsequently found to exist.

While publicity campaigns in New Mexico may have yielded few reliable reports of black-footed ferrets, these efforts have had the positive effect of sensitizing the public to the plight and needs of the species. This is an important element, which—coupled with greater resolve and enlightenment by land managers and wildlife biologists—should help stimulate us to do more to locate and conserve ferrets in New Mexico. Critical to this conservation is obtaining a better understanding of prairie dogs and their dynamics in the state, including in the face of the widespread, negative impacts—at least in Gunnison's prairie dog—of sylvatic plague. Until proven otherwise, prairie dog management should

be viewed as ferret management, and this viewpoint should be applied statewide.

RECOMMENDATIONS

We present the following as the most skeletal approach possible to the locating and conserving of black-footed ferrets in New Mexico.

1. Assume the ferret is still a member of the state's fauna and that it could occur anywhere that prairie dogs occur.

2. Conserve prairie dog towns statewide, with special emphasis on public lands—where these animals should be accorded a portion of the available forage and other resources in a genuine multiple use framework.

3. Where control of prairie dogs is justified, this should be done in a manner that will minimize the impacts on any ferrets that may be present. For discussion on the approach, see the appropriate section of this report.

4. Gaseous or secondarily-poisoning agents to control prairie dogs should not be used anywhere in New Mexico, as long as any possibility that ferrets or other protected, non-target wildlife will be killed.

5. Where prairie dog towns are to be impacted less severely than for purposes of control, employ the ferret survey methods of Clark et al. (1982). Whenever possible, avoid even minor impacts on prairie dogs by detouring around towns or similar approaches.

6. Carry out investigation on prairie dogs, including in such contexts as monitoring, forage use, population dynamics, and the impacts of sylvatic plague. Included in the latter aspect should be some investigation of the possibility of protecting prairie dog populations from the ravages of plague.

7. Wherever feasible, maintain, enhance, and/or establish refugial areas of prairie dogs on public lands, preferably in several areas that historically yielded ferrets. Apply single use management (i.e., conservation of prairie dogs) to the areas as needed to fulfill this recommendation.

8. Continue to solicit, evaluate, and investigate reports of ferrets from New Mexico, including through continuation of publicity campaigns. Surveys should be conducted in those areas from which the more reliable reports or other evidence of ferrets are obtained.

9. If black-footed ferrets are located, immediately restrict access to the area, protect the animals and their prey from disturbance, and develop and implement plans for monitoring and carrying out other steps that may be deemed necessary for their conservation—including capture and relocation to safer areas, e.g., as 7 (above).

10. Update, modify, and expand management approaches to prairie dogs and ferrets as needed to accomodate, incorporate, or otherwise apply new or revised information as it becomes available..

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We cannot possibly individually thank all of the hundreds of people who have contributed in some way to this report. Therefore, let us offer each and every one of you our gratitude for your contribution, and let us hope that you will continue to contribute so that the black-footed ferret will remain a part of the ecosystems of North America and hopefully of New Mexico. We accept full responsibility for any and all errors of whatever scale in this report, and we will appreciate their being pointed out to us. This document is being disc-stored for future revision by word-processor, and revisions will be made as necessary and desirable.

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